

INDUSTRIAL ENERGY EFFICIENCY, CO-GENERATION & CLIMATE CHANGE, AN INDIAN PERSPECTIVE

Presented by
**S. C. Natu, Vice President
MITCON LTD., PUNE, INDIA**

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INDIAN ENERGY SCENARIO

- ◆ Low per capita energy consumption (0.8 tonne of coal equivalent)
- ◆ Lower energy productivity (US \$ 400, GNP/ tonne of coal equivalent)
- ◆ Rising population & economic growth (respectively by 2-3% & 4-5% per year)
- ◆ Continued dependence on depleting commercial sources (90,000 MW installed capacity, 70% coal)
- ◆ Growth in energy consumption (10-12% every year)
- ◆ Demand in excess of supply (additional 60,000 MW capacity required by 2004 / 5)
- ◆ Low pace of energy efficiency improvement
- ◆ Insignificant contribution from renewable sources of energy (<2%)
- ◆ Severe shortage of funds
- ◆ Delayed initiation of the power sector reforms
- ◆ 15-30% T & D loss in different States
- ◆ Peak demand shortages of 8-30%, in different States
- ◆ Energy availability shortages up to 15%
- ◆ Un-realistic pricing of energy
- ◆ The obvious focus calls for
 - ▶ Drastic steps for energy efficiency improvement
 - ▶ Speedy tapping of the renewable sources of energy like bio mass (including bagasse co-generation), wind and small hydro
 - ▶ Power from co-generation in other sectors, municipal and industrial solid / liquid waste
 - ▶ Environment efficiency improvement for sustainable development

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POTENTIAL FOR ENERGY EFFICIENCY & COMBINED HEAT & POWER (CHP)

Sr. No.	Sector / Sub-sectors	Total Potential (MW)	Realisable Potential (MW)
1.	Energy Efficiency		
1.1	Industry		
1.1.1	Steel	1500	1000
1.1.2	Cement	1800	800
1.1.3	Paper	1000	800
1.1.4	Fertilisers	1200	900
1.1.5	Other sectors	2300	1500
	Sub-total (1.1)	7000	5000
1.2	Agriculture	8000	2500
1.3	Commercial	4000	2000
1.4	Other Sectors	1000	500
	Sub-total (1)	20000	10000

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POTENTIAL FOR ENERGY EFFICIENCY & CHP (Cont'd.)

Sr. No.	Sector / Sub-sectors	Total Potential (MW)	Realisable Potential (MW)
2.	Combined Heat & Power (CHP)		
2.1	Sugar	4000	3000
2.2	Dairies, Distilleries & Breweries	3500	2500
2.3	Rice mills	1500	1100
2.4	Cotton textile & man-made fiber	1200	800
2.5	Paper & pulp	1000	750
2.6	Fertilizers	1000	750
2.7	Chemical (solvent extraction, sulphuric acid, caustic soda)	900	600
2.8	Petrochemical & refineries	800	600
2.9	Metal industries (iron & steel, sponge iron & alumina)	750	500
2.10	Cement, tyre & plywood manufacturer	600	400
2.11	Other Sectors (coke oven batteries, commercial sectors, etc.)	750	500
	Sub-total (2)	16000	11500
	Grand total (1+2)	36000	21500

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STATUS & LESSONS LEARNED

A. STATUS

Sr. No.	Sector / Sub-sectors	Realisable Potential (MW)	Commissioned as of Sept. 99	Status (MW) Under construction / in pipeline	Total
1.	Energy efficiency				
1.1	Industry	5000	250	500	750
1.2	Agriculture	2500	100	200	300
1.3	Commercial	2000	100	200	300
1.4	Others	500	50	100	150
	Sub-total (1.1)	10000	500	1000	1500
2.	Combined Heat & Power (CHP)				
2.1	Sugar	3000	150	500	650
2.2	Dairies, Distilleries & Breweries	2500	50	100	150
2.3	Rice mills	1100	50	100	150
2.4	Cotton textile & man-made fiber	800	25	50	75
2.5	Paper & pulp	750	50	100	150
2.6	Other sectors	3350	300	500	800
	Sub - total (2)	11500	625	1350	1975
	Grand total (1+2)	21500	1125	2350	3475

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POTENTIAL FOR ENERGY EFFICIENCY / CHP AS CDM PROJECTS IN INDIA (Contd.)

Sr. No.	Sector / Sub-sector	Realisable Potential (MW)	Sector Maturity Rating	Investment (US \$ M / MW)	Carbon Credit Potential ('000 T / Yr. / MW)	Expected Capacity Replacement / Addition Potential (M T / Yr.)		
						Up to 2001 - 2005		
						2001	2005	2006 - 2010
2.	Combined Heat & Power (CHP)	3000						
2.1	Sugar		A	0.75	6.41	250	750	1000
						(1.60)	(4.81)	(6.41)
2.2	Dairies, Distilleries & Breweries	2500	B	0.70	7.68	100	300	500
						(0.77)	(2.31)	(3.85)
2.3	Rice Mills	1100	A	0.70	7.68	50	200	500
						(0.38)	(1.54)	(3.85)
2.4	Cotton textile & man-made fiber	800	B	0.70	7.68	50	100	200
						(0.38)	(0.77)	(1.54)
2.5	Paper & pulp	750	B	0.70	7.68	50	100	200
						(0.38)	(0.77)	(1.54)
2.6	Other sectors	3350	C	0.70	7.68	100	300	500
						(0.77)	(2.31)	(3.85)
	Sub-total	11500				600	1750	2900
						(4.28)	(12.51)	(21.04)
	Grand Total	21500				1200	3550	5400
						(9.40)	(27.88)	(42.39)

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CASE STUDIES ENERGY EFFICIENCY

Replacement of Conventional Vapour Compression Central Air Conditioning System by Energy Efficient Vapour Absorption System

Sr. No.	Parameters	Conventional	Energy Efficient
1.	System Capacity (TR)	125	125
2.	Type	Vapour Compression	Vapour Absorption, Water Cooled, FO Filled
Energy Consumption			
3.	Chiller Power (kw)	108	7.87
	Cooling Water Pump (kw)	8.0	9.58
	Chilled Water Pump (kw)	10.0	10.0
	Lower Side Power (same)		
	Total Power (kw)	126	27.37
4.	Fuel Consumption	Nil	0.33 kg/TR
5.	Cooling Water Requirement (lit/day)	17877	28920
6.	Equivalent Energy Saving per annum		24 lakh KWH
7.	Investment Cost, including machine, piping, fuel storage, freight, octroi, etc. (Rs. lakh)	15.25	47.04
8.	Total Operating Cost including Electricity, Fuel, Water, Maintenance, Interest, etc.	36.63	30.27
9.	Carbon Emission Reduction, MT/year (@ 1.067 kg/kwh)	-	2264
10.	Carbon Credit (@ US \$ 15 / MT)	-	33960

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CASE STUDIES (Cont'd) COMBINED HEAT & POWER (CHP)

Sugar Mill Co-generation Power Project

1.	Mill capacity	: 5000 Tones of Cane / Day (TCD) or 208 Tones of Cane / Hour (TCH)
2.	Canecrushing	: 9,00,000 MT / season of 180 days
3.	Bagasse generation	: 3,00,000 MT / season
4.	Captive steam requirement	: 105 TPH (50% on cane)
5.	Captive power requirement	: 6 MW during season, with electric mill drive
6.	Cogen plant installed capacity	: 20 MW (180 days on mill bagasse; 120 days on purchased bagasse / bio-mass / fossil fuel)
7.	Power export	: 12 MW during season, 7 MW during off-season (100 M KW/year)
8.	Project cost & means of finance	: Rs. 650 M or US \$ 14 M (25 % equity, 75 % term loan @ 13 % with interest subsidy)
9.	Project income	: Rs. 316 M @ Rs. 3.16 / KWH for 2001-2 AD
10.	DSCR / IRR / payback	: Average 2.0, 30 % on post tax & equity, 6-7 years
11.	Carbon emission reduction @ 0.3 kg/kwhr	: 30,000 MT / year
12.	Carbon credit / yr. @ US \$ 15 / MT	: US \$ 0.45 / year
13.	Major equipment /	: 66 kg/cm2 pressure boilers (2X70 TPH capacity), 1X20 MW DEC TG set, grid paralleling / interfacing equipment, water treatment plant & civil works
14.	Land requirement	: 25 acres of land

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ADDITIONALITY, BASELINE & OTHER IMPORTANT ISSUES

- The pace of implementation of energy efficiency & CHP projects in India is still very low, due to complexities of socio-political-economic issues and barriers, even after the phenomenal efforts of last 20 years. The situation may still continue over next decade. Any advancement of time span for implementing these projects, through mechanisms like CDM, itself is an additionality, over the baseline of continued low pace of implementation.
- Due to low volumes of production per industrial unit and technology level, the baseline for energy efficiency for different sectors will be different compared to the developed nations, where the production volumes and technologies are higher / superior and the energy efficiency levels are higher. The baseline for energy efficiency for Indian conditions must be agreeable for carbon emission reduction / trade internationally, by CDM partners.
- For combined heat and power projects for qualifying as CDM projects, sectoral baselines will have to be worked out for conventional or commercialised technology levels, along with clear-cut border line definitions, e.g. sugar mill cogeneration projects at 60 kg/cm2 pressure and temperature configuration are slowly getting commercialised in India, yet will require additional 3-4 years for full scale commercialisation. In such situation, whether 60 kg/cm2 project on IPP mode, conceived today, from project developer from say US can qualify as CDM project or not? Also, the power generation efficiencies will have to consider Indian technology as baseline for such projects. The extra high pressure configuration projects will certainly qualify as CDM.

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ADDITIONALITY, BASELINE & OTHER IMPORTANT ISSUES (Contd.)

- The Government of India will have to sign the Kyoto protocol to make CDM applicable for energy efficiency / CHP projects in India. A joint statement on co-operation in energy and environmental aspects signed on October 26th 1999 between Mr. Bill Richardson, Energy Secretary, USA and Mr. Jaswant Singh, Minister for External Affairs, GoI is crucial and needs to be followed up. Based on this the GoI has issued guidelines for preparedness for CDM to various concerned Ministries like MNES / MoEF / Mo Pand MNES becomes the major role player for these projects.
- Lot of facilitation at key levels is required to arrive at right kind of overall approach for CDM projects in India and methodology of defining the baselines / additionality. Creation of convergence of attitudes of all the stakeholders is most relevant.

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MITCON'S BACKGROUND

- Promoted by India's main financial institutions, public commercial banks & Maharashtra State Government Corporations
- 18 years of experience in industrial, technical & management consultancy services of diverse range in
 - pre-investment
 - project management
 - project finance
 - macro & policy studies
 - training & human resource development
- Focus service sectors
 - energy efficiency
 - environment
 - renewable energy
 - bio-mass & co-generation power
 - industrial infrastructure
 - sustainable building materials
 - rural industrialisation
 - information business
 - agri business
 - entrepreneurial training & promotion

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MITCON'S BACKGROUND (Cont'd)

- ISO 9001 company, professionally managed company, well equipped offices in Pune, Mumbai & New Delhi
- Working relations with all major stakeholders for possible CDM projects in India, in all focus sectors
- Linkages with similar State level Technical Consultancy Organisation in 18 States of India
- Experience of major macro studies & assignments like
 - Situation report on energy, All India Bagasse/Cogen Study
 - Application of energy efficiency data protocol for Indian sugar mills project brief for UNDP/MNES GEF
 - Removal of barriers to bio-mass power generation project
 - Lead Programme Partner of MNES for development of bagasse-cogen and bio-mass power projects
 - Business Development Associate of IREDA
 - Implementation of demo project for environment/energy efficient Vertical Shaft Brick Kiln project for SDC, having huge multiplication potential
 - Project developer interface services
 - Range of pre & post investment services for bio-mass / bagasse power projects
 - Energy audits
 - Environment Impact Assessment studies
 - Loan / grant-in-aid syndication services

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CDM / JI & EMISSION TRADE BUSINESS PERSPECTIVE, ENERGY EFFICIENCY / CHP SECTORS IN INDIA

POTENTIAL

Sr. No.	Item	Period			
		Up to 2001 AD	2001-2005 AD	2006-2010 AD	2001-2010 AD Cumulative
1.	Capacity Additions / Reduction (MW)	1200	3550	5400	10150
2.	Carbon Credit Potential (Million MT / Yr.)	9.40	27.88	42.39	79.67
3.	Total Investment Required (US \$ M)	732.50	2162.50	3330.00	6225.00
4.	Carbon Credit Business (@ \$ 15 / MT), US \$ M	141.00	418.20	635.85	1195.05

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CDM / JI & EMISSION TRADE BUSINESS PERSPECTIVE, ENERGY EFFICIENCY / CHP SECTORS IN INDIA (Cont'd)

BUSINESS OPPORTUNITIES

- Equipment & Project Supply
- Project Development & ESCO Models
- Financing & Leasing
- Carbon Credit Syndication
- Macro, Policy & Development Initiatives
- Consultancy / Advisory Services
- Other Services (O & M, etc.)

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CDM / JI & EMISSION TRADE BUSINESS PERSPECTIVE, ENERGY EFFICIENCY / CHP SECTORS IN INDIA (Cont'd)

PROPOSED LINKAGES

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RECOMMENDED ACTION PLAN

Sr. No.	Action Item	Responsibility	Suggested Time Schedule
1.	International intervention / facilitation with Govt for exact implications / preparedness for the CDM & further signing of Kyoto Protocol	MNES / MoEF / MoP / PMO / UNIDO / UNDP / CII / FICCI	Dec. 31, 2000
2.	Identification of concerned Ministries, stakeholders & potential facilitation agencies for industrial energy efficiency & CHP sectors in India	MNES / MoP / CII / FICCI / MITCON	Mar. 31, 2000
3.	Assessment & validation of total / realisable potential, sector and sub-sector specific	MNES / MoP / CII / FICCI / MITCON	Jun. 30, 2000
4.	Identification of projects in energy efficiency / CHP sectors meeting national / MNES priorities, potential for finance and technology in India	MNES / MoP / CII / FICCI / MITCON	Jun. 30, 2000
5.	Analysis & validation of barriers & preparation of barrier removal plan	MNES / MoP / CII / FICCI / MITCON	Sept. 30, 2000
6.	Preparation of stakeholder's workshops, sector / sub-sector specific, & prepare promotion / development plan	MNES / MoP / CII / FICCI / MITCON	Sept. 30, 2000
7.	Preparation of CDM simulation case studies, sector / sub-sector specific, determination of funding, additionally, formulation of baselines for qualifying emission reduction, standardisation of CDM project cycles, etc.	MNES / MoP / CII / FICCI / MITCON / International agencies	Dec. 31, 2000
8.	Develop the future institutional linkages	MNES / MoP / CII / FICCI / MITCON / International agencies	March 31, 2000
9.	Develop at UNIDO level, review / monitoring mechanism & schedule	MNES / MoP / CII / FICCI / MITCON / International agencies	Dec. 31, 2000

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