Issue#24

Annual report to be submitted by a designated consumer to designated agency

By-

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(EA- 3153)

Introduction:

This report pertains to the annual returns to be furnished to the **Designated Agency (DA)** by a ***fictitious*** **Independent Power Producer (IPP)** operating a **360 MW combined cycle power station** operating in a liquid fuel. This station was commissioned in the year 1999, and it was one of the 'fast track' liquid fuel power stations came up during that period. Being a power generating station, as per Sl. No. 14 of the schedule to the EC Act 2001, it qualifies as a **Designated Consumer (DC)** and furnished an annual return to **DA** is mandatory as per the Act.

This paper deals with the preparation of such an annual report for this power station. The problems associated in the preparation of such report and also the suggestions to improve the focus, scope, coverage and content of the report, are brought out in the report. The structure of the report, for the proposed IT enabling of this reporting system at a future date, is also included.

The basic issue:

Normally, the word 'compliance' connotes a scarcity mindset, where an unwilling person (or a business firm) is forced through legislation, to abide by certain rules and procedures. The 'annual returns' sought by the regulatory bodies through this route normally contain inaccurate, bare minimum stale data, with very little practical importance. The total exercise is reduced to an 'annual ritual', which is followed grudgingly.

In a traditional organization, furnishing such 'annual returns' is normally delegated to someone down below in the hierarchy. Such an exercise hardly draws serious attention and focus of top management. The preparation of such reports becomes an end rather than a mean. Top management will be normally happy with such 'statutory submissions' unless the statutory body raises some queries or something grossly goes wrong and attracts the wrath of the statutory body.

Utility / usefulness of furnishing such annual reports (other than complying with the statutory mandate) has to be analyzed from DC's point of view, to understand the key drivers and motivational factors, affecting the richness of data and quality of analysis, contained in such reports. DCs have to spend substantial resources in energy audits, compilation of data, analysis and follow up action plan, which form part of the annual

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report. Unless the DCs realize specific, attractive ROI, they will not commit scarce resources for such endeavors.

Hence, content, layout and structure of the annual reports should be designed in such a way that the DCs find the entire effort is a value added exercise and finds the report an important MIS and an invaluable tool to improve their own business performance. This broad requirement of the report is also in consonance with the objectives of EC Act, which is aimed at **'efficient use of energy and its conservation**".

Report structure for a 360 MW combined cycle station:

The report described here is specific to a 360 MW combined cycle station, which the author is familiar with. However, several concepts and issues discussed here are generic, and applicable many more categories of DCs.

Background information on the process:

The combined cycle power station is having two gas turbines Frame machines of 115 MW each and a two stage (HP & LP), condensing steam turbine of 130 MW. Naphtha is the main fuel and HSD is the startup fuel. The station deploys state of art technology control and instrumentation to control and optimize the process parameters.

During the initial 2 to 3 years after commissioning, the station operated in base load and performed exceedingly well. Several **best practice benchmarks** were established in terms of availability, reliability and efficiency parameters.

Of late, since year 2004-05 onward, due to increase in the naphtha fuel cost, station is not getting adequate generation schedule. Often the station has to work at part load, leading in lower efficiency and higher fuel and auxiliary fuel consumption. Frequent shut downs associated with the cyclic operations, as instructed by the grid, lead to additional startup fuel consumption. This operating regime at "off design point" compelled the station to spend more on startup fuel, and auxiliary power.

Hence, the main challenge for the station was to vigorously explore the ways and means to operate he station efficiently and to conserve energy to the maximum possible extent.

In this context, the station wants to make best use of the provisions of EC act to it's own best advantage. The yearlong exercise, culminating into year-end annual report, is expected to trigger several energy conservation projects, with due sanction / approval of expenditure budgets by the Management. The process of multi level scrutiny and review of expenditure proposals, with special focus on financial soundness of such proposals, is expected to bring about required awareness and commitment among the management hierarchy towards such energy conservation projects .

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The filled up form no. 1,2 & 3 for the station is attached in **annexure-1,2 & 3** respectively.

Following observations are made while filling up this form:

a)Common denominator for energy consumption:

This form attempts to compile the energy balance in the industry and the specific energy consumption (i.e. energy consumption per unit of production). With industries making use of multiple fuels with different grade / quality (eg.: GCV of fuel) and also possibility of switch over of fuel half way through, it is difficult for any meaningful comparison of the trend and targets over the years and also comparison between different companies (Eg.: Power station-X of Company A with Power station-Y of Company-B)

It is suggested to measure total energy input (from different fuels, aggregated) into the production in terms of K Cals and then to measure specific energy consumption (Eg.: during 2002-03, total heat energy input into production is 5000 X 10^9 K Cal, to generate 2500 MU of electricity. Then specific heat energy consumption is 2000 K Cal / KWH).

This method will help in trending, variance analysis and comparison with benchmarks.

b)Report content:

The format should contain the provisions for the following) [1] :

i)Norms (industry norm, global bench mark, top quartile etc.) : Which will force DC to think 'out of box' and to organize and deploy resources to capture industry best figures.

ii)Targets: This will force the DC's top management to fix stretched targets every year and to strive to achieve it. After a few years DCs them selves will realize the benefit of such stretched targets, in terms of improved productivity, increased profitability etc. Then onward, such efforts will become self energizing and self sustaining.

iii) Trends: Incorporating several years trends, as a part of the report will make the DC aware of the effectiveness of his EC efforts.

(*1- Adopted from EFQM business excellence model*)

3)Design of format and or website for Online reporting:

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From the outset, the DCs should be encouraged (and coerced if necessary!) to submit online reports through e-mail. Necessary provisions to be made for data security through the process of encrypting / e- signatures.

Further, DA can create a dedicated web site and DCs should be able to upload the annual report data into this web site. The data should be automatically uploaded into DAs central data base. DA should be able to automatically generate required reports from this data base, indicating trends, variances, comparisons etc.

The software for this data upload automation should be decided in advance and communicated to DCs in advance, so that conversion of massive data generated through incompatible softwares by different DCs can be avoided.

4) Redundancy of form-3:

The form –3 (executive summary) is basically and extract of form-2. This report has to be automatically generated by the proposed software at DA end, rather than Dcs generating this redundant sheet.

5) Two way information flow:

Normally the reports submitted under "statutory returns" goes into the 'black box' of the regulator. Nothing comes out of such submission. The agency submitting such returns will not get any feed back for his learning and improvement.

To make the annual report submission under EC Act a pleasant learning and introspection exercise and a high value addition annual exercise for the DC, systems can be designed for sharing industry best practice between DCs and DAs.

This two way communication will go a long way in promoting the noble objectives enshrined in the EC Act 2001.

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Annexure-1

Form 1

Format for information regarding total energy consumption and energy consumption per unit of production

Particulars	**Details**	**Remarks / Suggestions**
Name of Company	XYZ Power Generation Pvt. Ltd.	A **structured DC registration No.** may be given to each company (similar to PAN numbers for income tax payers) . The code should contain the details of industry, ownership (Pvt. / MMNC / State PSU / Central PSU etc.). **This will help computerized analysis category wise**
DC code	14	DC code may be assigned same code as appearing in schedule to the EC Act.
Rated capacity	360 MW (Gross) / 350 MW (Ex-bus)	
Process description	As per annexure (Separate sheet)	Separate sheets are not attached, since this is only a demo report
Year of installation / commissioning	1993-Unit-1 1994-Unit-2 1995-Unit-3	This will help in age wise classification, comparison and bench marking of comparable units, in a computerized regime.
Full address	Sun Industrial Estate, Lokthane, Maharashtra PIN 200 004	A central database of DC registration numbers can be initially created at DA end, so that DCs need not furnish this data every time. Once the DC submits his report against his registration number, other static data should be obtained from DA's central data bae.
Contact person	A Das Plant Manager	- DO -
E mail ID	a_das@xyz.com	- DO -
Telephone / FAX numbers	023-2345 5432 / 023-2346 6543	- DO -
Plant address	Sun Industrial Estate, Lokthane, Maharashtra	- DO -

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	PIN 200 004	

A. Power consumption norms:

Sl. No.	Particulars	Details	Remarks / Suggestions
1.	Electricity		
(a)	Purchased	Not applicable for a power station	
	-Contract demand		
	-Connected load		
	-Annual consumption		
	-Total cost		
(b)	Own generation		
(i)	-Thro' DG set	Not applicable for a gas turbine station	
	Annual generation (KWH)		
	Annual diesel consumption (K L)		
(ii)	-Thro' steam turbine generator	Covered under gas turbine, below	
	Annual generation (KWH)		
	Fuel used (K L)		
(iii)	-Thro' gas turbine		
	Annual generation (KWH)	2520 $X10^6$ (at 80% PLF)	Combined cycle steam turbine generation included.
	Annual fuel consumption		
	-Natural gas (SCUM)	Nil	New fields suggested for these data
	-Naphtha (MT)	4.46 Lakh MT (SFC:0.177 kg / KWH & Average GCV : 11,300 K Cal / Kg)	- DO -
	-Diesel oil (KL) (For start up)	240 KL (Average GCV: 10500 K Cal / Ltr.)	- DO -

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2	Coal quality (GCV)	Not applicable	It may vary during the year, depending upon the coal mines from where the coal is sourced.
	Annual consumption (MT)	Not applicable for gas station	
	Total coal cost (Rs Lahks)		
3	Oil		
(i)	Furnace oil	Not applicable for gas station	
	-Annual consumption (KL)		
	-Annual costs (Rs. lakhs)		
(ii)	LSHS	Not applicable for gas station	
	-Annual consumption (MT)		
	-Annual costs (Rs. lakhs)		
(iii)	Hot heavy stock	Not applicable for gas station	
	-Annual consumption (MT)		
	-Annual costs (Rs. lakhs)		
4	Diesel oil		
	HSD	Covered under 'startup fuel' at b (iii) above	
	-Annual consumption (KL)		
	-Annual costs (Rs. lakhs)		
	LDO		
	-Annual consumption (KL)		
	-Annual costs (Rs. lakhs)		
5	Gas		
(i)	Compressed natural gas (CNG)	Not applicable for liquid fuel station	
	GCV (K cal / NM3)		
	Annual consumption NM3		
	Annual cost (Rs. Lakhs)		
(ii)	Liquefied petroleum gas (LPG)	Not applicable for liquid fuel station	
	GCV (K cal / Kg)		

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	Annual consumption ^{MT}		
	Annual cost (Rs. Lakhs)		
(iii)	Piped natural gas (PNG)	Not applicable for liquid fuel station	
	GCV (K Cal / NM3)		
	Annual consumption ^{NM3}		
	Annual cost (Rs. Lakhs)		
6	Bio mass		
	Average moisture content, as fired (%)	Not applicable for liquid fuel station	
	Average GCV as fired (K cal / kg)		
	Annual consumption (MT)		
	Annual bio mass costs (Rs. Lakhs)		
B	Product mix specifications		
	Product name 1	Single product (electricity).	This scenario may undergo change in future, once Time of Day (TOD) generation and differential tariff rates become popular.
	Product name 2		
	Product name 3		
	Product name 4		

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Annexure-2

Form 2

Format for reporting status of implementation of energy conservation measures based on business plan of the company

Sl. No.	Description of measure	Category No. (From Form-3)	Investment (Rs. / lakhs)	Verified annual monitory savings (Rs. / lakhs)	Verified annual energy savings	Units	Fuel
01	Refurbishment / up gradation of gas turbine internals	11	……Pl. refer C. No. 11 of form –3…….				
02	Replacement of splash type fills with film type fills in cooling towers, leading to higher condenser vacuum and hence improved heat rate.	02	2.5	27.50	110	MT	Naphtha fuel
03	Renovation of HT motor driven pumps like BFP, CEP, CW pumps, CPHRC etc. (Through cartridge replacement, coating of fluid path components , internal leakage losses, impeller replacement, etc. as the case may be).	05	17	27.72	0.63	Million KWH	Electricity
04	Replacement of under loaded high capacity motors with new, high efficiency motors	04	55	189.64	4.31	Million KWH	Electricity
05	Providing optimum thermal insulation in HRSG and over process pipe lines	07	17	36.25	145	MT	Naphtha fuel

Note: Above data in their current 'stand alone mode' may be of little utility, unless the following is done:

a) Specific codes for each energy conservation measure, for IT enabling & for standardizing the reports.
b) Norms / bench marks for intra / inter industry comparison.
c) Guidelines for determining life cycle years.
d) Industry wide acceptance norms for EC projects, in terms of pay back period.
e) Objective mechanism of verifications (say thro' external energy auditors) .
f) Clarity on investment norms (Capital budget, revenue budget etc.).
g) Guidelines for project prioritization.
h) Guidelines for credit loading and rating of different EC measures, for subsequent merit grading of firms / industries on an equitable and objective scale.

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Annexure-3

Form 3

Executive summary of appraised energy conservation potential as identified in energy auditor report

C No.	Area of improvement and modification	Investment lakh Rs.	First year energy savings					First year cost reduction, lakhs Rs.					Life cycle years
			Oil	Gas	Coal	Electricity	Other	Oil	Gas	Coal	Electricity	Other	
01	Better house keeping measures (i)	1.0	50 MT					9.50					@
02	Process parameter improvement (ii)	2.5	110					20.9					@
03	Measures in the area of lighting (iii)	3.0				0.01 MU					0.44		@
04	Sizing, changing and controlling electric motors including VFDs (iv)	55.0				4.31 MU					189.64		5 #
05	Retrofitting, modification or sizing of fans, blowers, pumps including duct system (v)	17.0				0.63 MU					27.72		5#
06	Performance improvement of compressors and	0.50				0.079					3.48		01$

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	compressed air system (vi)												
07	Improved insulation against heat or cold losses (vii)	17.00	145 MT					36.25					01 $
08	Recovery of waste heat for process heat or power generation	----------Not applicable for the existing combined cycle power station……..											
09	Loss reduction of transformers and power distribution (viii)					0.86 MU					38.01		@
10	Fuel switching measures from fossil to fossil or fossil to renewable energy	----------Switch over from the current naphtha fuel to LNG fuel proposed after necessary fuel linkage and long term LNG fuel supply agreement. This expected during 2009-10. ----------											
11	Improvement of prime mover performance such as gas, steam, water, turbines or IC engines.	……Retrofitting of existing gas turbine components (blades, vanes, etc.) with latest version high performance components planned during next over haul cycle, scheduled during 2009-10…….											
12	Improvement of steam boilers and reduction of losses in steam distribution lines	----------Covered under (01) and (07) above…….											

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13	Modernization measures with benefits of energy consumption reduction	----------Will be incorporated in the proposed Renovation and Modernization (R&M), scheduled after 10 years of plant operation (i.e. 2009-10). ……

(i) Arresting steam, water and oil leakages, attending passing valves (Especially high energy BFP recirculation valves and high energy drains in steam lines),

(ii) Condenser vacuum improvement (thro' condenser tube cleaning, improving cooling tower effectiveness, sliding pressure mode operation of steam turbine, maintaining rated pressure and temperature of HRSG, maintaining gas turbine compressor efficiency through online water wash, maintaining gas turbine inlet filter DP within allowable limits, etc.)

(iii) Lighting audit leading optimization of illumination level, timer / photo sensor based street lighting and yard lighting, proximity sensors in conference hall and corridors, switch over to sleek 36W tube lights and T5 fixtures, switch over to high efficiency SV lamps, periodic cleaning of lighting lamps and fixtures, etc.

(iv) Replacement of lightly loaded ventilation fan motors, VFD for BFPs and HVAC compressors (later for usage during lightly loaded condition during night).

(v) Trimming of BFP impeller to reduce excess head developed . Reduction in power consumption is 87 KW Duty: 300 days / year)

(vi) (a)Reduction of loading/ unloading set point pair of compressor, after assessing the minimum pressure requirement at the farthest point (b)Leakage survey of compressed air distribution header (c) use of small, local blowers for service applications. (Reduction in power consumption is an average 11 KW, duty cycle 300 days)

(vii) Thermal insulation survey of HRSGs, flue gas duct between gas turbine and HRSG and steam lines. Attending hot spots on HRSG surfaces and re insulation of ducts and pipe lines showing increased temperature over and above design value of 50*C.

(viii) Optimal loading of transformers through transfer of load into one transformer and switching off of other transformer (8 tfrs., with iron loss of 15 KW each, 300 days operation). Reduction in phase unbalance by re distribution of single phase lighting loads among three phases.

@- This is an ongoing efforts in process optimization and the benefit will accrue as long as these efforts continue Hence life cycle years are not relevant here.
- Performance level expected to be maintained for 5 years, before going for next refurbishment / rebuid.
$- Annual event

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