Recommendation for Aggregated Data Reporting under the EC- Act

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1. Objective: Introduce a minimal set of aggregated energy reporting data satisfying the criteria of being (i) innovative, (ii) value added to designated consumers, (iii) can be electronically evaluated and analyzed by BEE, (iv) satisfies BEE's mandate to contribute validated and accurate national energy consumption and conservation statistics leading to allocation efficient national EC policies.

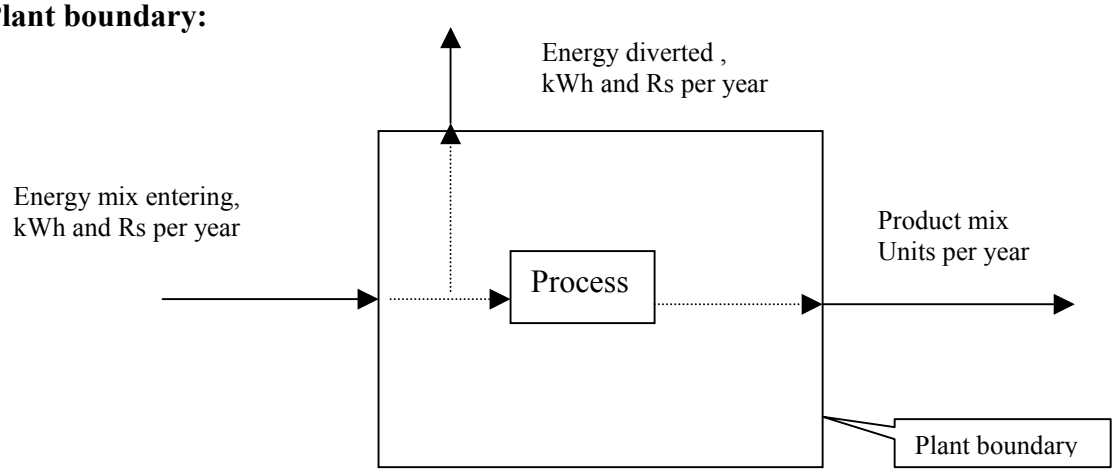
2. Aggregated data definition and presentation: Data which gives on **one** page in graphic form enough information for a decision maker to initiate a change and ask questions to those are responsible for the data as well as energy management in a firm.

3. Energy consumption unit: Only kWh based on GCV as energy unit for all forms of energy is acceptable for data collection and analysis, irrespective whether the energy sources are electricity, coal, gas, oil, or biomass. Conversion factors are 3600 kJ = 1 kWh and 4.18580 kJ = 1 kCal.

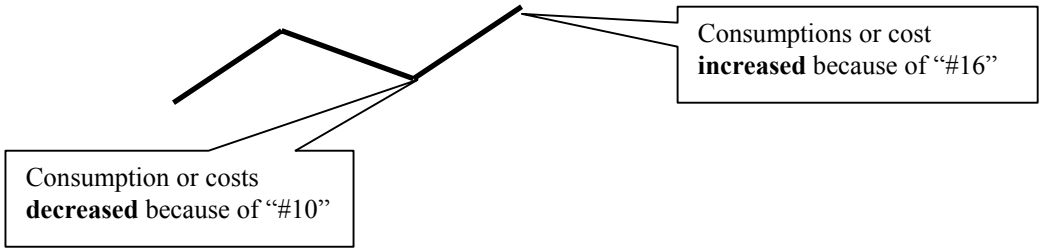
4. Indicators

a) Costs of **energy mix** in Rs/kWh (monthly basis)
b) Specific consumption in **kWh/unit product mix, (**monthly basis**)**
c) Specific energy costs in **Rs/unit product mix, (**monthly basis**)**

Plant boundary:



5. Pop up explanations for change in consumption and costs:



There should be an agreed list of reasons why consumption or costs went up or down. This list should be discussed with industry and occasionally refined. Shop level operators or mangers should only state reasons from the list. BEE may add other reasons to the list if necessary over time. The list should not state **effects**, but only state **causes.** "Decreased plant load factor" is not a reason, but an effect caused by other reasons as shown under # 4 - # 6.

a) Increased specific consumption or cost list

#	**Reason of increased energy consumption kWh/unit output**	**Reason for increased energy cost Rs/unit output**
1	Increase in forced outages	Fuel cost increased
2	Increase in scheduled outages	Specific consumption increased
3	Labor unrest	Revenue from diverted energy flow decreased
4	Reduction in output due to lack of fuel	Output mix changed to more energy intensive products
5	Reduction in output due to lack of resource material	…
6	Reduction in output due to high inventory.	….
7		….

b) Decreased specific consumption or cost list

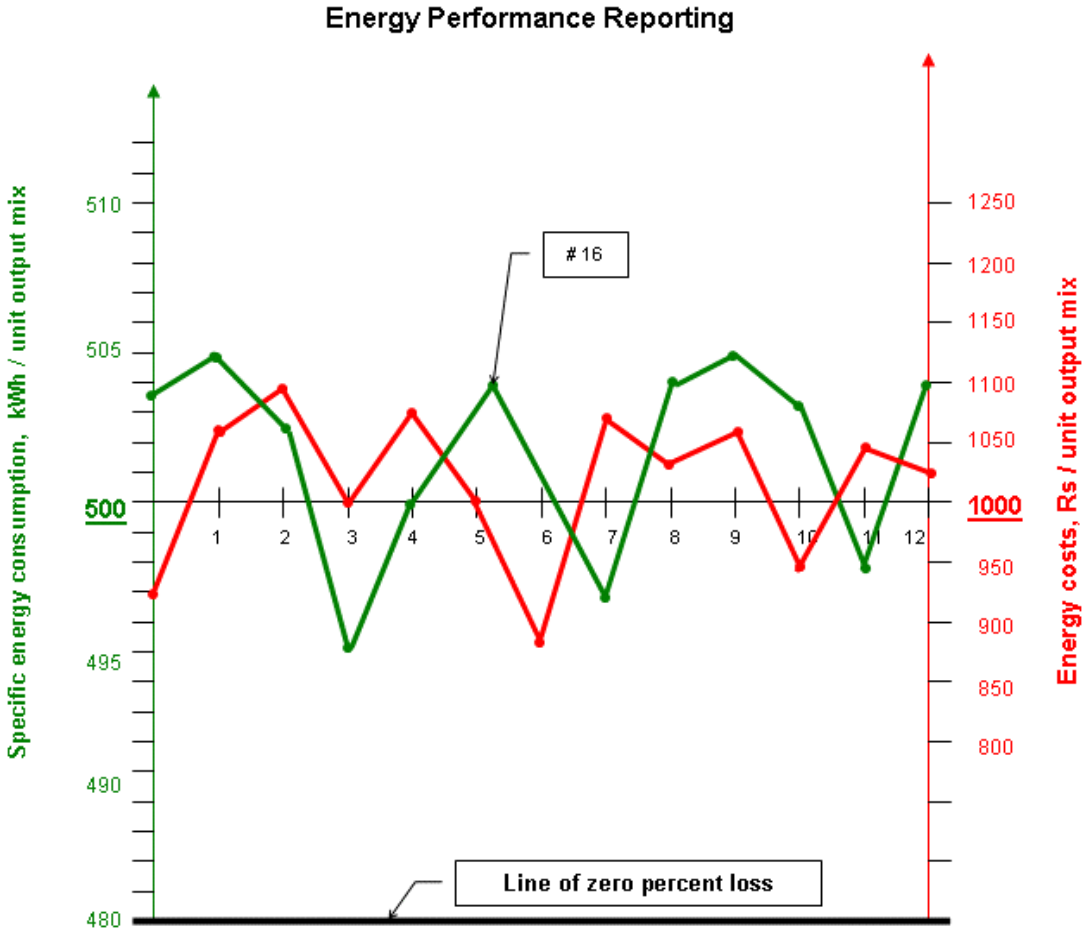
#	**Reason of decreased energy consumption kWh/unit output**	**Reason for decreased energy cost Rs/unit output**
1		
2		
3		
4		
5		
6		
7		

It is an observation that some reasons usually given by industry for decreased or increased energy consumption are ambiguous. For instance the claim that specific energy consumption goes down whenever the plant load factor of a machine or an entire plant goes up is not always correct. Take as an example a Diesel Generator Set. Operating at a PLF of 80% for a day will certainly result in less grams of oil consumed per kWh output then operating at PLF of 100%.

6. Graphical representation

The following graph is an example of the proposed graphical presentation format, which satisfies all criteria to discuss plant performance data at an aggregated level to support decisions for change. Both technical and financial data are superimposed on a single graph.

The right and left Y-axes' scales should be set so that the red and green curves are close together to allow improved visual analysis. Such curves can be automatically generated from spreadsheet data including the analysis. In cases of a complex product mix it is difficult to get the zero percent loss line. BEE should provide a fully automated data-recording sheet for experimental purposes to interested industries in October 2004.



Legend:

(i) The right Y-Axis displays the energy costs in Rs per unit output mix.
(ii) The left Y-Axis displays the specific energy consumption in kWh per unit output mix.
(iii) The X-axis is the months of the present year.
(iv) The underlined bold figures **500** and **1000** are last year's average values. Last years average value 500 is calculated as total annual kWh consumption divided by total annual production, while the average value of 1000 is calculated as total annual energy costs divided by total production. This is different from calculating the average of last year's monthly values.
(v) An alternative is to show last year's best data (i.e., lowest specific consumption), which would move the read and green line higher.
(vi) The peaks and valleys are labeled with pop up boxes stating the reason number from the list why consumption or costs went up or down.
(vii) The horizontal bottom line on the graph is the theoretical specific energy consumption assuming zero percent losses.
(viii) The monthly energy savings potential is calculated by subtracting the theoretical specific energy consumption at no-loss (line of zero loss) from the actual monthly specific energy consumption (green line's value), then multiplying this difference by the monthly production. Summing this over the year is the annual energy savings lost opportunity.
(ix) Similarly, the monthly energy cost savings potential is calculated by subtracting the theoretical specific energy cost at no-loss (line of zero loss) from the actual monthly specific energy cost (red line's value), then multiplying this difference by the monthly production. Summing this over the year is the lost opportunity for energy cost savings.

7. Qualitative rating of energy conservation and energy efficiency measures

All energy conservation and efficiency measures in addition to the technical/financial assessment should be qualitatively rated by a simple color or letter code of Gold (A), Silver (B), Bronze (C) and Red (F).

Rating matrix for EE and EC measures

A. Consumption decreased **and** Costs decreased Example: Financially attractive Cogeneration plant **Gold**	**B.** Consumption increased **but** Costs decreased Example: Fuel switching from gaseous or liquid to solid fuel due to price differential in Rs/kWh for solid fuel. **Silver**
C. Consumption decreased **and** Costs increased Example: Most cases of fuel switching from solid fuels to liquid or gaseous fuels. **Bronze**	**F.** Consumption increase **and** cost increase Example: All investments in new energy intensive equipment with no life cycle cost analysis or mandatory environmental pollution control measures. **Red**

EE= Energy efficiency measures
EC= Energy conservation measures

The reason is that sometimes it is not so clear whether the measure reduces energy costs, reduces energy consumption (i.e, improves energy efficiency), or both. The following matrix is helpful for BEE as well as for a firm. The color coding is given from the point of view of a firm and not from the point of view of BEE or a pollution control board.

8. Justification for selection of indicators

a) Costs of plant specific **energy mix** in Rs/kWh

This is the most important indicator for a company and should be carefully watched. This indicator reflects a plant's ability to implement a long-term energy strategy that adjusts the energy mix in response to fluctuating energy costs to maintain either a constant or decreasing specific energy cost. In other words, it reflects a firm's ability to manage, purchase and deliver its energy mix at the least possible cost.
This indicator accounts for all energy imported or exported across the plant boundary in form of electricity, oil, gas, coal and biomass.

This indicator changes when plant energy efficiency goes up or down only if energy is also re-exported by a plant and value added. Otherwise it is independent from EE or EC measures. However to make it a meaningful indicator the GCV of all fuels must be known and occasionally checked, even those of standard furnace oils. They may contain too much water which everybody admits does not burn very well.

b) Specific consumption in **kWh/unit product mix**

At the aggregated level only the product mix should be looked at and a common unit found. This indicator should never be seen in isolation and only shown in a graph together with the third parameter "specific energy costs/unit product mix." It is quite possible to reduce "kWh/unit product mix" but at the same time increase "Rs/unit of product mix"; a less desirable scenario for a firm. Attention must be paid if energy and with it energy costs flows are diverted in a plant, say power generation where part of the power is exported out of the plant for profit. This could either increase or decrease the indicator no matter how efficient operation is.

c) Specific energy costs in **Rs/unit of product mix**

This indicator is important to BEE because in combination with the market price of the unit production one may identify firms and sectors where motivation for energy efficiency measures should be very high, at least on paper. Any firm with energy costs 60% of the total production costs is a better candidate than firms with 1% energy costs.

9. Data submittal, recording and analysis by BEE

There are neither technical nor infrastructure barriers to receive data electronically in table form for automatic processing, analysis and summary generation. For administrative reasons it is far better for BEE to get the raw data in table form and generate a uniform output.

10. Benchmarking, Indexing, Norms, Color Coding and Bar Labels

Indexing is a questionable habit of industrial sectors where the sector firms compare themselves and determine who the best is based on some often obscure parameters. Such practices also lead to superficially setting "best possible values" with the predicted result that some are always better then the best possible values, ridiculing the entire approach.

Benchmarking requires considerable efforts because individual plant components or sub processes of larger systems must be monitored and analyzed. However it is still the best way to identify areas of improvement. Looking at benchmarking from a financial point of view there is a simple and quick way to establish a benchmark, "The ratio of annual energy consumption over annual book depreciation of the equipment". It should be obvious that the higher this ratio is the higher the potential to reduce energy costs at good returns.

Energy consumption norms are to be recommended by BEE under the Energy Conservation Act. It will be difficult to enforce norms and to set just normative consumption. The necessity to set norms is also not obvious because the Act is a case of a law which forces firms to make more profit. It is therefore better to market the intention of the Act instead of enforcing it. The case of a firm arguing that they make enough profit may be a rare case. There is one important exception, the public power industry. Plant specific norms should be set and fuel consumption costs in tariff orders only accepted based on this normative value.

Color Coding of a designated consumer based on initially self declared "kWh/unit product mix" is a rough but effective way to divide all firms of an industrial sector into four colors (gold = A, silver = B, bronze = C and tin = F). From a national policy point of view it is important to encourage narrowing the specific energy consumption bandwidth. From a national resources point of view, support should be given for "color hopping" from C to B and B to A, and encouraging the A's to share know how of why they are in A and even getting better every year.

However such classifications only make sense if at the same time a bar code label is established with respect to the specifics of the technology, resource material and product mix of a firm. One must accept the fact that a "C" firm because of their technology, capacity, and age cannot become Gold but may follow a Gold standard in terms of their energy conservation efforts.

Firm ⟶	**CarBest**	**CementHigh**	**TextilBest**	**TextilWorst**
Bar Code Label	Gold	Bronze	Gold	Tin
EC – Efforts	Tin	Bronze	Silver	Gold

Attention should therefore be paid to the CementHigh firm due to lack of efforts and TextilWorst should be awarded for their efforts. The CarBest firm has most likely exhausted their financially attractive options to reduce energy consumption.

11. Subsidies and EC funds

There is a difference between good and bad subsidies (= incentives). One cannot always argue that subsidies are necessarily bad. However in the absence of any

validated and accurate data about the energy consumption bandwidth of designated consumers it is too premature to talk about allocation efficient policies. No appraisal and overview exists concerning policies of other Government entities at the union or State level that may be detrimental to the mandate of BEE.

12. A firm's and the nation's EE and EC policy

Define " kWh_{best} /unit product mix" as the specific energy consumption at 0% loss as given by the bottom line in the graphic. Then a firm's EE and EC policy as well as that of the nation reduces to two sentences:

"We declare to undertake any efforts to reduce
the cost of our energy mix (Rs/kWh)"

"We declare to undertake any efforts to reduce the difference of
kWh/unit product mix - kWh_{best} /unit product mix

There is nothing more to say. The beauty of practical policies is that they are brief and the impact is measurable and quantifiable. It is then only a matter to set a benchmark by how much the second declaration is implemented. The first one may be derailed by world politics.

Did you know that if the number 100 is reduced by 2% every year, we end up with 82 in ten years! If 100 are reduced 7% every year, we end up with 50 in ten years. Consequently reducing the losses by 2% every year is achievable. Cutting the losses in half in ten years would be a tall order for most firms' and would require substantial investments in new technologies, which are only justified if it is foreseen that a firm cannot stabilize the energy mix indicator Rs/kWh.

13. Industry acceptance

The estimated 5000 – 7000 future notified and designated industrial plants falling under the EC-Act are fairly large and most may already have data monitoring and analysis systems in place. There should be no problem to present this previously collected data in a slightly different way. This will also help company management to improve decision making with respect to EE and EC measures. A larger issue is that firms already report all kinds of data to numerous Government agencies, with BEE being another one added to this list. In terms of marketing it is therefore important that firms have some value added benefit from reporting to BEE and that reporting is not seen as disclosing propriety information which could be used against the firm.