TeleEnergy Plants...
...in the Perspective of Quality

Christer Boije af Gennäs,
Lennart Ahnmarker, John Åkerlund
Televerket, Swedish Telecom Network Services, Sweden

"Quality management is not just a strategy. It must be a new style of working, even a new style of thinking. A dedication to quality and excellence is more than good business. It is a way of life, giving something back to society, offering your best to others."

George Bush

ABSTRACT

The concept of Quality, when applied to telecommunications energy plants, has been limited for a long time to reliability, ruggedness against power disturbances, endurance and technical lifetime. This paper derives customer satisfaction and, in the final analysis, "Value for Money" from the end user's point of view, as the main quality criteria, for energy systems as well. As an attempt to interpret these criteria into more concrete terms, a ***total cost model*** *for the energy system is presented, as well as some ways to use it, so that more value is obtained for less money. The paper also briefly describes TE2000, a project based on the Total Cost Model, which was recently started by Swedish Telecom Network Services.*

INTRODUCTION

The words above, quoted directly from the President of the United States, open the 1992 Award Criteria document for the Malcolm Baldrige National Quality Award. In a few years the MBNQA has gained recognition as the world's leading quality criteria, with numerous followers over the world. It establishes the concept of Total Quality Criteria.

The MBNQA does not outdate predecessors such as the ISO standards. Nor does it make obsolete the philosophy of *kaizen* (continuous improvement) or the messages of gurus like Deming, Juran, J. Ham and Ishikawa. They can instead be considered as subsets of the Baldrige criteria, or methods to achieve them.

Let us briefly review the core values and concepts of the Baldrige criteria:

- Customer-driven quality
- Leadership
- Continuous improvement
- Full participation
- Fast response
- Design quality and prevention
- Long-range outlook
- Management by fact
- Partnership development
- Public responsibility

Fair enough. All of the above criteria do confirm our intuitive perception of quality.

But problems sometimes arise when you have to substantiate the criteria to convert them into rules which are applicable to the specific situation. You experience some problems in identifying the criteria.

If you put yourself in the specific situation of the person responsible for telecom energy systems in one of the telecom administrations or telecom operating companies, you see the problem immediately.

As opposed to the Baldrige criteria, in this situation you would normally specify something similar to the following list as *your* perception of quality:

- ►Function and disturbance-free operation
- ►Technical performance
- ►Reliability
- ►Ruggedness against handling and voltage spikes
- ►Endurance and long technical lifetime

You would also specify:

- ►Availability of spare parts
- ►Service when you are in trouble
- ►Supply of how to and know how

Some of these criteria can be traced back to Baldrige, of course. Obviously, they are all very important parameters.

But somehow it is hard to avoid the feeling that many of the criteria go right back to the technical specifications. And, supreme technical data is not the same as quality. (If the equipment supplier fails to meet the specifications he promised you, *that* is poor quality).

So, somewhere there may be a perception gap between the quality theory and the people working with concrete problems.

Below, we will try to interpret the criteria of customer-driven quality and customer satisfaction into a form that also has relevance for the energy manager working in a telecom operating company.

THE TeleEnergy CONCEPT

The activities of power and cooling systems have long led an obscure life within most telecom operating companies. The technology has been considered trivial compared to the other telecom equipment, and their economic significance has been a well hidden secret.

The fact that cooling and power systems - AC and DC equipment - have been treated as entirely separate technologies, and are often handled by different organizations, has contributed significantly to this obscure position. It is very rare that any single organizational unit gains a comprehensive overview of all systems, which are frequently classified as auxiliary systems.

In Televerket (Swedish Telecom) both power systems and cooling (air conditioning) equipment needed for the *telecom process* are now considered as belonging to the same area of activity, telecommunication energy or **TeleEnergy** for short.

Even though the technologies differ, TeleEnergy equipment has a common purpose: to give life to the telecom system and secure a decent environment for it by handling the energy flow for the telecom process.

A breakdown of the energy consumption for a large central office is shown in Diagram 1. It should be noted that the different parts are heavily dependent on each other.

The TeleEnergy concept makes it easier to optimize both the cost and the performance of the system. It may even help reveal hidden costs.

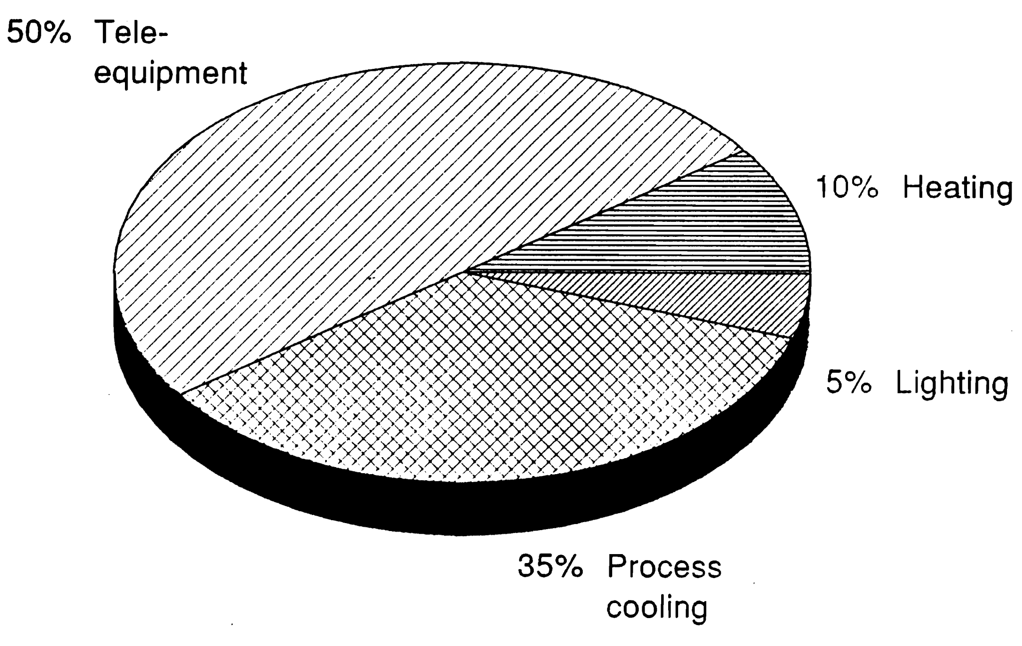

Diagram 1. Distribution of TeleEnergy consumption in a large digital central office

DEFINING QUALITY

What is QUALITY? And how do we apply the general concept of quality to TeleEnergy systems?
It depends quite simply on who you are.
If you are a supplier of energy systems or a user of such equipment, you have some values in common, but also a lot that differ.

The Quality Manager usually defines the ultimate criteria of quality as *customer satisfaction* - value for money, that is. This definition is also reflected in the Baldrige National Award as the most important criteria.

But *who* is the customer?
For the supplier of power plants it is easy: the buyer and user in the telecom operating company - the person in charge of TeleEnergy systems.

But who is the customer for the guy working with energy plants in the telecom operating company?
Is it the boss?
The switching people?
The people responsible for operating the network?
The end user of the telephony system, the subscriber, the "you-and-mes" all over the world?

You may conclude that it must be the *end user*. If he is dissatisfied and somebody can track the cause of his dissatisfaction down to you, that is definitely *your* quality problem.

The end user is always the ultimate judge in the Supreme Court of Quality.

But again the customer, by definition, is the one who pays the bills. Sure, the subscriber pays the bills (not always, but that's a different story).
But, he is not paying for the pleasure of using the energy system. He is paying for the services of the network.
The TeleEnergy system does not generate any direct income from the subscriber. Its costs must be covered by the revenues from the network.

So the real customer of the TeleEnergy system must be *the network*.

So, how is the network getting *value* for its money?

VALUE

The TeleEnergy plant is giving value (and, as a matter of fact, life) to the network components by feeding them with power and providing them with the appropriate environment. This must be done with sufficient reliability and with energy according to the technical specifications. A lack of power must never appear to be the factor that greatly reduces the overall availability of the network.

Methods to achieve this, and to define the extent of reliability, is what about 90% of the content of Intelec conferences have been dealing with in the past, so we are not going to delve on this subject right now.
Let us just state that, although it sometimes can be a problem, well established methods do exist in that field.

So, the network is getting VALUE.

Let us now compare this value and what the network has to pay for it.

MONEY

Any model for calculating the total cost of the TeleEnergy system must take into account the operating costs, as well as financial costs for the capital used.

The costs must also reflect the gross cost level, including *quality costs*.

A somewhat simplified definition of *quality costs* could be the amount of money it takes to reach a certain quality level in the system, plus costs incurred because of a lack of quality. This means that both costs caused by system failures and costs for checking the operation of the system come under the label *quality costs*.
A wider definition of quality costs should also allow the inclusion of imperfections in the engineering process, resulting in, for instance, overdimensioning of the TeleEnergy plants, and the costs related to it.

The cost model must also be a global model, reflecting how costs caused by the TeleEnergy systems affect the bottom line of the income statement for the entire telecom operating company.

In this case it will then be possible to relate these costs both to revenues and other costs of the company.
But it will still be difficult to judge whether the costs are reasonable. TeleEnergy equipment accounts for an astonishingly large portion of the total bulk cost, but you do not have the option to eliminate the equipment. You can only say, that it definitely seems worthwhile giving some priority attention to it.
At this point it also becomes possible to calculate key figures which are comparable to other companies in the same type of business. This is what is usually called *benchmarking* in quality terminology.

THE TOTAL TeleEnergy COST MODEL

At Televerket in Sweden (Swedish Telecom Networks) we have been working on developing and making calculations based on a TeleEnergy cost model.

As seen from the table, costs are divided in two different categories: *operating expenses* and *financial costs (capital costs)*.

Here are some comments to the different items in the table (figures refer to corresponding numbers in the table):

1. It showed that the cost for electric energy and fuel for standby generators and vehicles (used in the maintenance of energy systems) is far from negligible. As a matter of fact, energy is the only *raw material* used in the telecom process. As such, it certainly deserves some attention when studying production efficiency.

2. The costs for operation and maintenance are based mainly on manpower. They depend on the total number of persons working with TeleEnergy systems within the entire company, including overhead and management, plus the use of external resources.

3. This item includes spare parts, material and expenses for operation and maintenance and the use of common resources, such as documentation, computer systems and purchasing.

4. The costs for failures caused by TeleEnergy systems are very difficult to specify. It is easiest to just calculate the loss of income and cost for repairs. However, methods exist to evaluate the loss of goodwill related to the downtime of telecom traffic for customers. These values must be used with the utmost caution, but are nevertheless significant and must be included when the telecom company is operating in a competitive environment.

Instead of using *present value calculations* and other more or less tricky methods to estimate the future cost burden from the investments, we use *real-time capital costs*.
This gives us the actual costs each year for depreciation and interest on the capital employed, based on the company's normal methods to calculate financial costs. One of the advantages is that the obtained figures are directly comparable to the financial costs for the entire network.

5. Investments in equipment are depreciated according to a time plan that may vary according to the type of equipment.

6. Interest paid on the residual (non-depreciated) value of capital invested in TeleEnergy equipment: this can be the actual interest on loans, or it can be the expected return on capital used in the company, or a nominal internal interest rate used in the company.

It has been discussed whether capital costs for the premises occupied by TeleEnergy equipment, as well as for special arrangements like air ducts and canalization for power cables, should be included or excluded from the calculations.
We must include these costs so we can appreciate the advantages of space-saving TeleEnergy solutions.

The Total Cost Model for TeleEnergy

	Millions US$
Operating expenses	
1. Costs for consumed energy	___
2. Costs for operation and maintenance including staff, overhead, etc.	___
3. Spare parts and other material for maintenance and non-investment replacements	___
4. Costs for failures, incl. calculated loss of goodwill	___
Capital costs	
Based on the yearly investment level and X years time of depreciation	
Net residual value MUS$ _____	
5. Depreciations	___
6. Interest on the residual value	___
Yearly financial and operational costs for the TeleEnergy systems of a telecom operating company.	___ Total

CONCLUSIONS FROM THE TOTAL COST MODEL

The figures in the Total TeleEnergy Cost Model are directly comparable to figures in the income statement for an entire networks operation.

Preliminary calculations made by Televerket according to the model, indicate that costs generated by TeleEnergy systems have a significant impact on bottom line figures in the income statement of the telecom networks.

As a matter of fact, a first rough estimation indicates that more than 10 percent of the gross cost of the network can be traced to TeleEnergy.
This has come as something of a surprise, both to the energy people and to top management in the company. It is more than likely that the situation is similar in other telecom operating companies over the world.

In the past a large portion of the costs were frequently hidden in other costs and investments. Actually no single person had an idea of the total picture. For example, the costs for both acquiring and operating the air conditioning systems, exclusively needed for the telecom process (namely cooling of the switching equipment) were accounted for as building costs and paid for in the form of building rent. Another example is switch room power equipment which is very often classified as switching equipment without any afterthought whatsoever.

The consequence is obvious:

If you don't know what the costs are and where they come from, you don't know how to cut them.

WHAT CAN YOU DO ABOUT IT?

When we have a model for estimating costs, we also have the option to try to turn the knobs and adjust the total cost down to a lower level.
Our first review of the total cost model left us with an estimation that there should be a potential for reducing costs by about 15 percent, or probably more.

This estimate was based mainly on three assumptions:

● More precise dimensioning of the energy plants leads to better utilization of the equipment, higher efficiency, lower investments and decreased energy losses.

● Better monitoring and supervision of the TeleEnergy equipment give you facts for the more precise dimensioning. It also opens way to new approaches in maintenance and fault prevention. *Dynamic maintenance* according to the latest theories now seems to be in reach. This would lead to less manpower on the operation and maintenance side, but also to higher availability. "Catch the faults in planned way, just *before* they occur."
Maintenance based on knowledge about the actual status is far more efficient than maintenance based on statistics.
The exciting concept of dynamic maintenance of TeleEnergy systems is still one to be addressed in future Intelec sessions.

● More modern solutions for power and cooling systems. Extensive use of modular equipment, switch room power and space-saving solutions suddenly seem very attractive when you see the costs for space, canalization and capital.

In the long-term perspective, the total cost model could be used to evaluate the possible advantages of using power-down and other energy saving technologies in the design of new switching and transmission systems.

It could even justify the cost of more expensive solutions in the switches!

THE TE2000 PROJECT

Realizing the great potential for cost savings, we recently started a project in Televerket that attempts to use the comprehensive overview of both technological and economical aspects when it comes to TeleEnergy. The project is called **TeleEnergi 2000** (abbreviated as **TE2000**) and was initiated directly by the Head of Telecom Network Services.

The main target of the TE 2000 project is to achieve a 15% reduction in total cost, as defined by the Total Cost Model above, while improving at the same time the performance of TeleEnergy equipment in the network. Performance in this case shall be seen as the resulting availability and ruggedness of the telecom system served by the energy equipment.

As reductions in investments take a rather long time before they impact the bottom line of the Total Cost Model, the project will have to run for several years before we can prove that we will reach the target.
Although there are many ideas about measures which can be implemented to reach the objective, there is also plenty of uncertainty about their effect.

You could say we have set up the goal without knowing the exact route to get there. A truly challenging, but realistic, task in the line of overall quality!

It goes beyond the scope of this paper to describe the TE 2000 project in detail, but if there is interest for it, we hope to report more about the progress of TE2000 in the future.

CODA

To define *quality* in the TeleEnergy system we have used the criteria of *customer focus and satisfaction*. The customer, being the Network, sees the Quality as *value for money*.

The *Value* is defined as how well the TeleEnergy equipment fulfills its task to keep the telecom system alive and in good shape, at all times.

The *Money* can be derived from the Total TeleEnergy Cost Model.

The best way to improve TeleEnergy quality must be to improve performance continuously, at the same time as the total cost is constantly decreased by using *all* parameters in the cost model in an intelligent way.

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