CRITICALITY OF ASSETS

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ABSTRACT

In the Asset Management world we can find many considerations about the necessity to manage in priority critical assets. In this paper we have considered 2 methods, the € conversion & the extended FMEA.

INTRODUCTION

The criticality of asset is a very important notion. How to be sure to invest correctly if you don't know what is important. Anyway, the notion of critical is not to confuse with the one of urgency.
Urgency tells about the prioritization of job.
For sure, a complete action plan will integrate both.

DEFINITION

A clear definition of criticality is needed.

A critical asset is by definition an asset that may have an important impact on the business values. The chosen business values are:

- Health and safety
- Economic performance
- Environment
- Regulatory compliance
- Customer satisfaction
- Branding

EURO CONVERSION

In this technique, the failure of an asset is translated into amounts of euros. We have considered 2 types of cost:

- The direct cost corresponding to the repairing cost
- The Financial cost corresponding to the valorization of the unused energy (VUE)

Failure rate

It is important to have good data about failure rate for each asset. These failure rates were assessed with internal data, with international data and, when appropriate, in workshop with exploitation engineer.
These failure rates were expressed in % of the population / year.

Population

It seems to be an evidence but knowing the population of the all asset base is not so an easy thing.
The granularity of this information is not always in line with the granularity of the data available for the failure rate.
It is important to choose correctly the level of detail we need to go.

Valorisation of not used energy

Within the (VUE) valorization of the unused energy, we introduce also the valorization of the "trouble" for the consumers when they are disconnected and the lost of revenue.
For the "trouble" for the consumer, VUE cube methodology was used. This cube alloys to allocate VUE for 2 dimensions,

- Type of consumer (residential, commercial, industry, farmer…)
- The period for these consumers (day, night…) when a failure occurs. It is important to note that each consumer has its own period's definition. For instance, the residential type has day week – day weekend & night period.

Integrating over the different periods of occurrence (consumers type and periods) it is possible to calculate an average value. For our exercise we chose 6.8 € / kWh.

For the loss of revenue for DSO, we only consider an average grid fee.

Then we have to evaluate for each asset the amount of unused energy in case of failure. To do that we consider 1,5 x number of LV consumers (as proxy for kW) and the duration of an intervention on this asset failure.
For example, an intervention on a MV cable, takes 1,5 hours and impacts 600 kW.

Direct cost

For each asset failure we compute a direct cost. These cost integrate the cost to re-power the network and the cost of the reparation. For example, when a MV cable failed, it is possible to integrate the cost of emergency power generator and cable reparation.

Results

For each asset, the 2 costs are integrated and it is possible to make a ranking.

The formula is:

P X Fr x (Dc + Cens)

With P=population of this asset
Fr = Failure rate
Dc = direct cost
Cens = valorization unused energy

Conclusions

As result, we can consider that we integrate 2 business values, customer satisfaction (with CENS) and economic performance (with direct costing)
The same exercise can be done for all other values (environment, regulatory compliance, branding and H&S). The difficulty is to find a good cost driver for these.

Anyway, the top 3 of our assets with this exercise is:
MV cable
LV derivation rings
LV isolators

This exercise has a big advantage to convert intangible things in a scale that everybody understands.
But the assumptions to go to this result and the workload are big issues.

EXTENDED FMEA

The purpose of this method is to use so few data as possible and to complete the assessment with workshops.
To make a FMEA analysis, we use the multiplication of the impact index and the frequency index. This methodology is also known as the risk matrix methodology (or Boston Matrix).

Scoring of the frequency

It is possible to express the frequency with a number of failure / year but also as a reliability value.
The following tables show examples of scoring the frequency of failure.

PROBABILITY of Failure	Reliability	Ranking
Frequent	70,00	10
	75,00	9
Reasonably probable	80,00	8
	85,00	7
occasional	90,00	6
	95,00	5
remote	99,00	4
	99,50	3
Extremely Unlikely	99,90	2
	>99,95	1

As you can see, this scoring is linear.

Never	1>x>0% 1/30 years
Seldom	20>x>1% 1/ 10 years
Infrequent	40>x>20% 1/ 3 years
Occasional	70>x>40% 1/ year
Regular	90>x>70% 1/ 4 month
Frequent	>90% 1/ month

When we are assessing an asset, we are also assessing its population. This is because the question remains to "how many failure / year do I have from this asset?"
It is evident than to understand if we have a 100 or a 1000 of these equipment, even if the failure rate is the same, the number of failures / year will be different.

Scoring of the impact

General scoring

To give a score to the impact of a failure, such a table can be used:

Severity	Comments	Ranking
Hazardous without warning	Very high severity ranking when a potential failure mode affects	10
Hazardous with warning	Very high severity ranking when a potential failure mode affects	9
Very High	System inoperable with destructive failure without	8
High	System inoperable with equipment damage	7
Moderate	System inoperable with minor damage	6
Low	System inoperable without damage	5
Very Low	System operable with significant degradation of performance	4
Minor	System operable with some degradation of performance	3
Very Minor	System operable with minimal interference	2
None	No effect	1

Criteria for each values

For each value a separate impact scoring is developed.
These scorings are balanced, in the sense that the impacts in the different values are considered to be equal. A Very High score for H&S must be equivalent to a very high score in environment or branding.
To make this equivalence possible it is important to find good values indicators. This exercise is quite complicated and a lot of discussion can occur. Upon this, due to the fact that these scorings are very sensitive for investment decision, it is necessary to have a senior management agreement.

Results

For each asset and each value, a scoring of the frequency and impact is done, e.g. Primary substation

- Health and safety:
  - Frequency: 3
  - Impact: 8
  - Total: 24
- Economic performance
  - Frequency: 3
  - Impact: 9
  - Total: 27
- Environment
  - Frequency: 3
  - Impact: 1
  - Total: 3
- Regulatory compliance
  - Frequency: 3
  - Impact: 8
  - Total 24
- Customer satisfaction
  - Frequency: 3
  - Impact: 8
  - Total 24
- Branding
  - Frequency: 9
  - Impact: 3
  - Total 27
- Total scoring: 129

Note: in this case the frequency is the same for every value. It is possible to introduce difference by values.

Working in this way, the assessment gives a complete other result. But some issues in the understanding of the final score arise.

Conclusion

The general scoring of the impact was too linear.
If an asset is good in a value but bad in an other one, the 2 scores will compensate and will give a wrong view of the criticality.
After review, we decide to adopt a multiple scale for impact as:

3000	Catastrophic
600	Very High
120	High
25	Moderate
5	Low
1	Very Low

With this new scoring, we also define a risk tolerance. This tolerance (as limit in frequency x impact) is a warning on each value about unacceptable risk. So, even if the total scoring is the sum of each value, we keep the multi-dimensional view.

But, still the results are difficult to communicate:
"What does it mean score of 560 on H&S?"
An important knowledge transfer between the "asset assessor" and management is needed.

GENERAL CONCLUSION

Even if the second method seems to be more complicated to communicate, the low workload, and "easy to use" are such decisive advantages, that we would recommend this methodology.