Substation LifeStretch™
The right action at the right time
Substation Lifestretch™ Investment Strategies

A new approach to identifying optimal investment options for substations

After 30-40 years of operation, the reliability and performance of a substation inevitably declines.

Age, environmental impact and operational patterns contribute greatly to the gradual deterioration of substation equipment. Additional factors influencing substation performance include quality of the maintenance actions, serving personal expertise and spare parts availability.

When the substation life cycle reaches the design limits, it is time to make a decision about its future. Multiple technical solutions can be considered to extend the substation life by keeping and even improving reliability of the power supply.

ABB has developed LifeStretch methodology to address this challenge.

ABB’s goal is to help customers select an optimal solution for aging substations considering the customer’s explicit conditions and requirements.

Substation LifeStretch is based on a collaboration process that allows customers to:

- Evaluate existing level of substation reliability based on the equipment condition assessment and reliability statistics
- Identify different technical alternatives based on the current substation condition as well as customers’ specific needs.
- Compare the potential solutions according to multi-objective criteria focused on the decision making process.

Substation Lifestretch Approach

Substation risk assessment

The first step to identifying the optimal solution is to perform a substation risk assessment. This requires collecting all relevant information regarding the substation’s current condition, which is then used to prepare the substation model, including the configuration and components information (single line diagram, list of components, maintenance backlog, etc.) The risk assessment involves all components and subsystems of the substation impacting its performance:

- Transformers and tap changers
- HV equipment - eg, circuit breakers, disconnect switches, instrument transformers and surge arresters
- MV switchgear
- Protection and control system
- Station auxiliary equipment
- Infrastructure – eg, steel structures, foundations, fencing and grounding
- Health and safety
- Environment

As a result of the substation assessment, ABB will obtain a comprehensive overview of the substation risk based on the analysis of the operation & maintenance documentation, thorough condition assessment and detailed reliability analysis.

Component Ranking

<table>
<thead>
<tr>
<th>Component ID</th>
<th>Manufacturer</th>
<th>Year</th>
<th>Condition</th>
<th>Importance</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1E1-Q0</td>
<td>BBC</td>
<td>1984</td>
<td>28,06</td>
<td>50,67</td>
<td>55,37</td>
</tr>
<tr>
<td>T2E4-Q0</td>
<td>BBC</td>
<td>1984</td>
<td>23,67</td>
<td>50,64</td>
<td>47,14</td>
</tr>
<tr>
<td>T3E7-Q0</td>
<td>BBC</td>
<td>1984</td>
<td>19,68</td>
<td>64,05</td>
<td>30,07</td>
</tr>
</tbody>
</table>
Definition of Alternatives

Taking into consideration the asset’s current status, the substation reliability analysis will allow the LifeStretch team to define possible technical solutions focused on mitigating any risk and fulfilling specific customer’s requirements and objectives, such as:

- Outages, frequency and duration
- Mean Time Between Failure (MTBF)
- Initial Capital Investment
- Operation and maintenance cost
- Life cycle cost for a defined period of time
- Health and Safety
- Environmental impact, aesthetics, flexibility, etc.

Reliability analysis

To enable the most efficient allocation of investment capital, ABB provides customers with a new perspective on how to make those tough choices. By incorporating third-party data such as SAIDI, CAIDI, and SAIFI, the LifeStretch team can display the system’s network, targeting key areas for investment that will improve system reliability.

ABB default reliability library is based on public sources that can be reviewed by the LifeStretch team and the customer. It is also possible to build up a customer-specific reliability library for the project based on the customer’s own reliability records or other available sources such as IEEE, CIGRE, and others.

Once the system modelling phase is finished, the ABB service team will perform the calculation for the identified technical alternatives. The results of the analysis are presented in a comprehensive report giving a solid technical background for the decision making process.

Lifestretch results & conclusions

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Selecting the optimal solution

After performing reliability and economic analysis for each of the proposed substation LifeStretch alternatives, a final decision will be made to select an optimal solution. A comprehensive technical report presenting the conclusions of the study is generated and facilitates the decision making process while keeping the accuracy of the technical collaboration performance.
**Action plan agreement**

In order to validate the results of the study, which is a basis for the investment decisions, the following aspects must be taken into consideration for the solution implementation:

- Technical quality of the project execution according to the study assumptions
- Site works operational strategy (duration of works and partial down times if applicable)
- Life cycle support to correct deviations within the shortest delay

Once the investment choice is decided, ABB will propose an action plan based on the LifeStretch team conclusions.

**LifeStretch methodology benefits**

ABB’s substation LifeStretch will enable customers to:

- Include operation and maintenance experience in the analysis
- Understand the risk associated with each substation component
- Be actively involved in the definition of the risk mitigation alternatives
- Design tailor-made criteria to compare the risk mitigation alternatives
- Quantify and make conclusions to make the right investment decision for the substation life extension

The outcome of the LifeStretch collaboration process is a solid comparative analysis that allows customers to decide which the most convenient investment choice is.

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