

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.

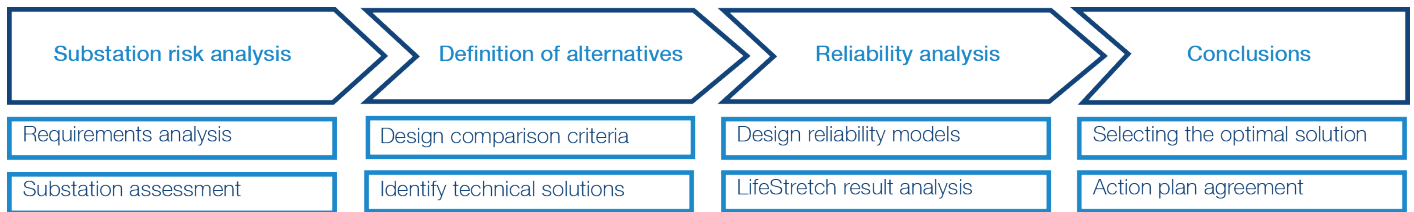
ABB has developed LifeStretch methodology to address this challenge.

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

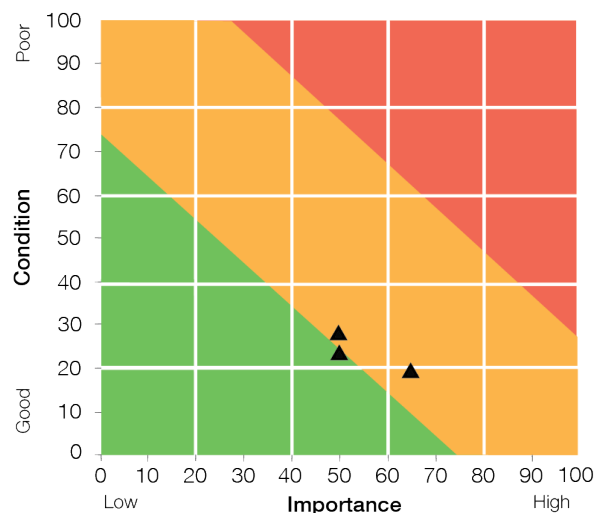


Substation risk assessment

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

Component ID	Model	Manufacturer	Year	Condition	Importance	Risk
T1E1-Q0	ELK-S02	BBC	1984	28,06	50,67	55,37
T2E4-Q0	ELK-S02	BBC	1984	23,87	50,64	47,14
T3E7-Q0	ELK-S02	BBC	1984	19,68	64,05	30,07

Definition of Alternatives

Taking into consideration the assets 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.

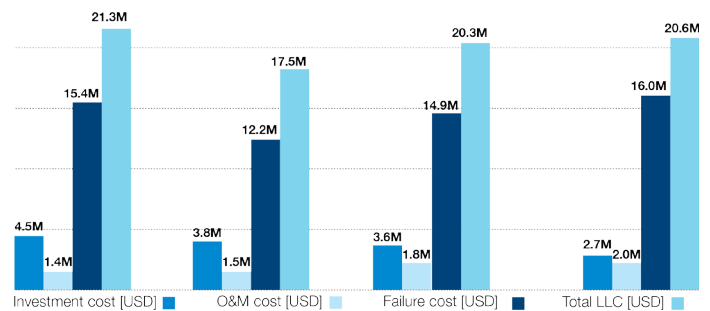
Lifestretch results & conclusions

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

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 customized reliability library for the project based on the customer's own reliability records or other available sources such as IEEE, CIGRE, and others.

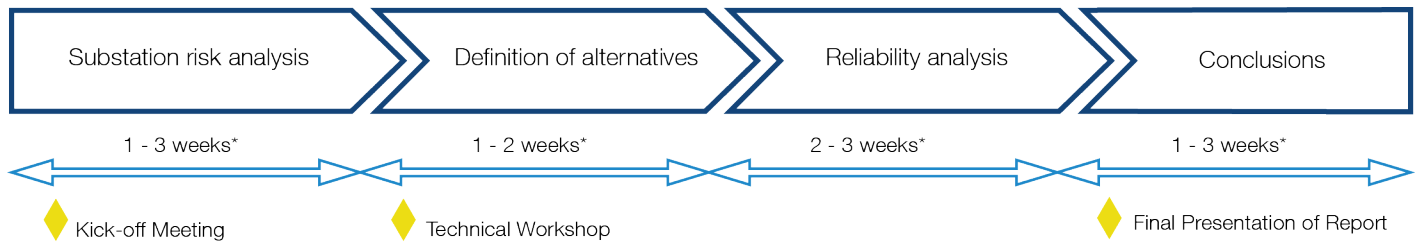


Selecting the optimal solution

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.



LifeStretch Execution Plan



	Kick-off Meeting	Technical Workshop	Final Presentation of Report
Workshop objective	Understand the customer need and specific project circumstances. Coordinate the details of the collaboration process. Evaluate the current condition of the installation.	Analyze the conclusions of the Substation Assessment. Collecting the information required to perform the reliability study. High level design of potential technical solutions to discuss within the workshop.	LifeStretch team with a clear understanding of pros and cons of the analyzed solutions.
ABB preparation tasks	Collecting information for modelling of the existing substation.	Calculation of substation risk map. High level design of potential technical solutions to discuss within the workshop.	Perform reliability analysis of the identified technical alternatives. Prepare a clear presentation of the LifeStretch results.
Workshop deliverables	LifeStretch team members definition. Project requirements definition. Perform Substation Assessment.	Definition of technical alternatives to analyze. Definition of comparison criteria for selecting an optimal solution.	LifeStretch report including a comprehensive analysis to serve as a solid base for the final decision making.

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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