



'Climbing used to be the worst part of my day. Using the Climb Auto System is much better for my knees and when I get up the tower I am not so tired anymore.' - Wind Technician

Retrofitting solutions to improve health & safety and maximize returns

In Europe today, it is standard to equip newly built wind turbines with service lifts. These allow technicians easy access to all levels of the tower. Many older turbines do not have this advantage and require operations and maintenance personnel to ladder climb instead. On such wind farms, there are countless soft tissue injuries due to the repetitive motion of climbing. These injuries lead to sick days, reduced motivation and can stress the operation efficiency of the project.



3S Lift offers specialized retrofit solutions for existing turbines that allow technicians to ascend towers more quickly and protect their health against the strain put on the body by climbing. This way, they can reach the top rested and start their work right away.

Over the last 20 years, 3S Lift has become a leading global wind turbine tower internals (WTTI) solution provider. With locations in China, India, Europe and the US, the company supplies a wide range of products to wind turbine manufacturers, tower manufacturers, service providers and wind farm owners across more than 40 countries.

Retrofitting existing wind turbines with these solutions can add considerable value, improving both, health & safety and economic performance. That's why a number of large developers are currently retrofitting their entire fleet with 3S Lift access equipment. One developer in the US has chosen to install 1,500 Climb Assists into his turbines. Other customers have ordered hundreds of Climb Auto Systems, a groundbreaking 3S Lift innovation that is taking the wind industry by storm.

Climb Assists alleviate technicians from some of the strain of climbing and can be retrofitted to almost any ladder. 3S Lift's innovative Climb Auto System, eliminates the need for climbing completely. This single technician ladder-mounted lift can transport

personnel or equipment and offers a variety of benefits. It reduces CAPEX and OPEX compared to a service lift and is easily retrofitted in any modern wind turbine. It is mounted to the existing ladder and can often be installed in 8 hours or less. Worldwide, 40,000 Climb Assists and 30,000 Climb Auto Systems have already been installed.

Improved health & safety

The repetitive motion of climbing towers puts extraordinary strain on the muscles and joints of technicians and causes countless injuries. These injuries lead to sick days and reduced motivation among technicians. The decreased technician availability stresses the project's potential to maximize operational efficiencies. With the Climb Assist, technicians can climb the ladder with substantially less strain on their body. Even better, when using the Climb Auto System, technicians can safely reach the top of a tower putting zero stress on their muscles and joints.

'Climbing used to be the worst part of my day. Using the Climb Auto System is much better for my knees and when I get up the tower, I am not so tired,' a technician told us.

Cost savings through reduced technician turnover

Wind turbine technician is a fast-growing job, but sometimes sees high turnover rates and limited job longevity if technicians need to climb towers on a daily basis. Solutions like the Climb Assist and especially the Climb Auto System will improve technician satisfaction, resulting in more competent and longer tenured employees. The higher employee retention will lead to lower turnover costs.

Increased AEP through climb time savings

According to feedback from wind farm owners and operators, a typical technician may be able to climb an 80m tower in 10 minutes. Once they reach the nacelle, they take a rest, as it is a strenuous activity to climb a ladder of 80m or more. The use of a Climb Assist makes this considerably easier and less taxing on the body. The Climb Auto System reaches the top

of an 80m tower in under 5 minutes and the technician is fresh and ready to begin efficient work immediately.

Improved uptime through proactive maintenance

On wind farms with Climb Assist type turbine access equipment, a typical technician performs between two and three climbs a day. When no climbing devices are available, ascents are kept to a minimum. On wind farms with service lifts or Climb Auto Systems, the total average ascents per technician exceed four per day.

This leads to a reduced delay of crucial maintenance, as technicians are no longer pressed to bundle activities in order to keep the number of ascents to a minimum. Necessary maintenance is completed in a more timely manner, leading to increased uptime, extended turbine life and lower operational costs. The increased number of tower ascents therefore leads to an increased AEP.

Labor cost reduction through increased technician efficiency

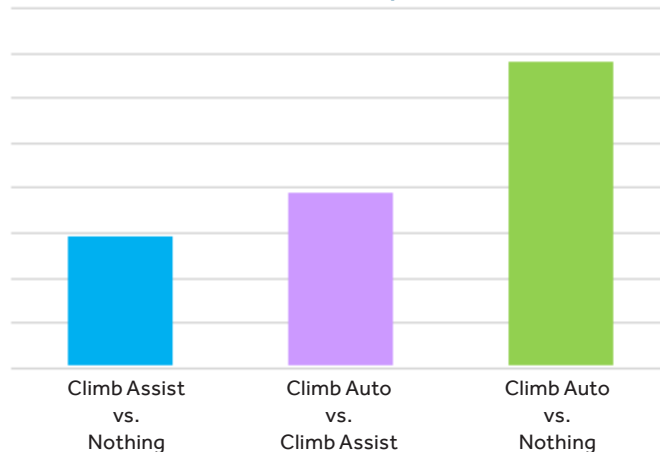
On large wind farms or in areas with many small wind farms, there is typically one team of technicians for every 8-10 turbines. If those wind farms were outfitted with Climb Assists or even Climb Auto Systems, they could decrease their headcount by up to 10% and save on labor costs. The efficiency of technicians would increase and the chance of climbing related injuries would be reduced.

The bars below represent ranges of financial benefits from an increased AEP and improved uptime savings per each scenario. Results vary depending on individual parameters of the wind farm. The basis of this comparison is a wind farm with 8 turbines of 1.5 MW, 60 meters height, 25% average net capacity factor and 7 years remaining project life.

Overall benefit of retrofitting a climbing system

There are great advantages for the health & safety of technicians when a Climb Assist or Climb Auto System is available. Furthermore,

Total financial benefit per turbine





Climb Auto System by 3S Lift

there can be considerable financial benefits.

The graph, on the previous page, illustrates this for 3 different scenarios with savings of up to five digits per turbine:

- 1 Retrofitting a Climb Assist into a turbine, which has no climbing aid
- 2 Replacing an existent Climb Assist with a Climb Auto
- 3 Retrofitting a Climb Auto into a turbine which has no system.

As shown, depending on the system chosen, there are increasing benefits from a higher AEP and improved uptime savings. Further savings that are not yet included in this calculation are: decreased labor cost due to fewer injuries and sick-days, lower retention cost due to less training and the higher efficiency of more experienced technicians, and the potential of a reduced headcount. They would come on top of the savings shown, creating an even bigger financial benefit from retrofitting turbines with one of the systems.

Climb Auto System

The 3S Lift Climb Auto System completely eliminates the physical and mental strain of climbing. It features safety control switches on both handles, a remote mode for the easy transport of tools, and collapsible pedals for rapid evacuation in the event of an emergency. It offers independent fall-arrests for both personnel and the system itself, providing utmost safety.

The Climb Auto System can be easily retrofitted to almost any wind turbine – often

Benefits

- Improved health & safety
- Higher satisfaction and motivation
- Greater employee efficiency
- Higher technician retention
- Increased uptime and AEP
- Decreased amount of sick leave
- Lower hiring and training costs
- Reduction of labor costs

in 8 hours or less. Mounted to the existing ladder, the installation typically requires no changes to the wind turbine structures.

It reduces the cost of ownership compared to service lifts, both in terms of capital and maintenance costs. Its annual inspection can be completed in just 1 hour. 3S Lift has installed this system in over 30,000 wind turbine towers worldwide. It is certified in accordance with CE, UL, ANSI, OSHA, and more, fully complying with the requirements of all major markets.

The fall protection system of the Climb Auto System is independent from the operator's fall arrester. Using this dual fall protection system ensures the safety of personnel and equipment. To ride it, the operator must press and hold the switches on both of the handles, thus ensuring safe operation.

Should the operator release one or both of the switches, the system will stop immediately. By holding both switches, the operator takes a compact stance, which provides for safe passage through platform hatches. Foldable footboards allow for rapid evacuation in case of an emergency.

The ladder-mounted guide rail, which the Climb Auto System runs on, strengthens the ladder and acts as the fall protection system for the operator and the system itself.

The system can be operated manually, remotely from anywhere, and via the control cabinet down tower. Priority is always given to manual control of the operator standing on the Climb Auto System, to ensure safety. Tools and equipment can be transported using the metal tool box provided. The box is secured onto the foot pedals and materials sent up or down tower using the remote control.

The variable frequency drive technology automatically balances the lifting force to ensure a smooth and stable ride. When approaching a platform, the Climb Auto System audibly alerts the operator. The running speed is reduced while passing through the platform to ensure safety. The optional Auto Hatch System can be used to automatically open and close platform hatches so that it can pass through safely and easily.

Climb Assist

The 3S Lift Climb Assist is at the forefront of modern Climb Assist design. Made specifically for the use in wind turbines, it provides constant lifting force for technicians ascending and descending wind turbine towers, alleviating the load and reducing fatigue.

By using variable-frequency vector control technology, the system provides lifting force for both ascent and descent. Equipped with advanced adaptive technology, it automatically adjusts to the climber's speed. No hand operation is needed for starting and stopping, meaning the user's hands are always safely on the ladder. The constant lifting force of 30–50kg for ascent can be easily adjusted, based on the operator's body weight.

The descent assistance offers a constant lifting force of 30kg. This helps the operator reduce stress on the body, especially on the joints in their knees and ankles, when climbing down the ladder.

Designed to require minimal maintenance, the Climb Assist's annual inspection can be completed in just 1 hour. With nearly 40,000 installations worldwide, this has become the trusted solution for customers everywhere. It is CE and OSHA compliant and valued by customers around the globe for its proven safety, reliability and ease of use.

www.3SLift.com



Climb Assist by 3S Lift