



EMERGENCY RESTORATION SYSTEM

DNV's solution for temporary power
transmission lines

OUR SERVICES



DNV's Emergency Restoration System



Building on over 45 years of Emergency Restoration System (ERS) experience in the Netherlands, a country with one of the highest grid reliabilities in the world, our ERS is designed to restore power within hours at any voltage in any landscape and weather conditions. Our ERS high-quality design is a result of deep technical knowledge, critical customer feedback and in-field requirements of contractors. Our Emergency Restoration System has successfully been deployed by numerous Transmission System Operators (TSOs) and Overhead Line (OHL) contractors around the world. Our Emergency Restoration System is in use by more than 20 customers all over the world.

Designed to beat the clock

Power failures are always unplanned and unwanted. Transmission towers and lines are subject to planned attacks and environmental disasters (e.g. storms, earthquakes, flooding, landslides, etc.) which worsens yearly due to climate change. Our Emergency Restoration System is designed to restore power flows as quickly as possible. We have devised a unique tower hoisting system designed to be fully erected within four hours, making manual assembly possible.

Designed for reliability

Our Emergency Restoration System has been designed and tested in accordance with International Standards such as IEC 60826 and EN 50341 for overhead lines. For the services and supplied materials, you can rely on DNV's ISO 9001:2015 and ISO/IEC 27001:2013 certifications.

All of our towers are tested to the IEEE 1070 guideline and all relevant parts are tested to international standards (i.e., IEC).

Designed for flexibility

The Emergency Restoration System is made of standard, interchangeable components, making it versatile. All our tower types use the same basic components. The key variable is the type of insulators required by each tower type. With sufficient basic parts and insulators, towers can be converted from suspension to angle to dead-end tower and reversed.

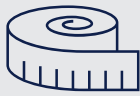
Designed to be transported

Each Emergency Restoration System tower comes complete in its own 20-foot container. Smaller components, fittings and fasteners are stored in boxes, while our custom insulator and corona ring storage system racks make both storage and inventory checks of critical components quick and easy. All components have dedicated locations in the container so verifying that all parts are present is very easy to do.

Our Emergency Restoration System is a top-class versatile, tried and tested system that exceeds industry engineering standards. It is fast and easy to erect and comes in its own, permanent storage solution, making it easy to store, maintain and transport to any site.



300+
systems sold worldwide



100+
kilometres installed



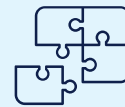
45+
years of experience



QUICK
fully erected in 4 hours



COST EFFECTIVE
made from steel



VERSATILE
interchangeable and modular



SAFE AND RELIABLE
exceeding industry standards



DESIGNED FOR TRANSPORT
neatly stored in 20-foot containers



COMPACT AND LIGHT
with a maximum weight of 140 kg per section and a required workspace of 16 m²



MODERN SYSTEM
it can meet line requirements from 88 kV to 765 kV
resist high wind and ice loads

We use steel

Why should you use steel for the ERS towers instead of aluminium?

Aluminium has a lower weight density and is a corrosion-resistant material. We have made extensive calculations on both steel and aluminium tower sections for emergency restoration systems. We modelled a single pole restoration system with a 500 metre span and ten Beaufort wind speed. Each tower has to hold three 230 kV phases with a twin bundle line of 795 mm².

We found out that you need more material for aluminium towers to compensate the strength and stiffness limitations. Even as steel is heavier than aluminium, you save on weight, and ultimately, storage space! As you have to erect more and heavier aluminium towers for an ERS track, construction time will be longer, which is not desirable when you are racing against time. Aluminium is also more brittle. If it is too heavily loaded it will fail immediately. Steel, on the contrary is more flexible and can absorb higher tensions and will deform first before failure.

ERS applications

Transmission lines are designed to transmit and supply continuous and reliable power. With a growing world population and an increasing share of renewables in our power system, our power grids capacity and resilience is a growing challenge for Transmission System Operators all over the world. Increased power production by renewables can lead to congestions in the grid, resulting in curtailment of green power. Higher demands for power and the need for security of supply may interfere with required maintenance schedules. On top of this our power systems are also subject to natural disasters and planned human attacks.

Our Emergency Restoration System is an ideal solution to mitigate operational and financial risks. Our system is a low-cost investment and used all over the world for emergency response, maintenance work, new construction and even to create medium- and long-term measures to alleviate system grid constraints.

The DNV ERS is the perfect solution for different applications

EMERGENCY RESTORATION

Restoring power quickly in case of an emergency when the existing transmission system has been damaged.

SYSTEM MAINTENANCE

Reducing outage time required during maintenance. The ERS is used by TSOs to create a temporary bypass during maintenance work in order to maintain the flow of power.

SYSTEM BYPASS

Creating construction bypasses during line upgrade work where transmission lines cannot be taken out of service. A parallel ERS line can be constructed to keep the lights on.

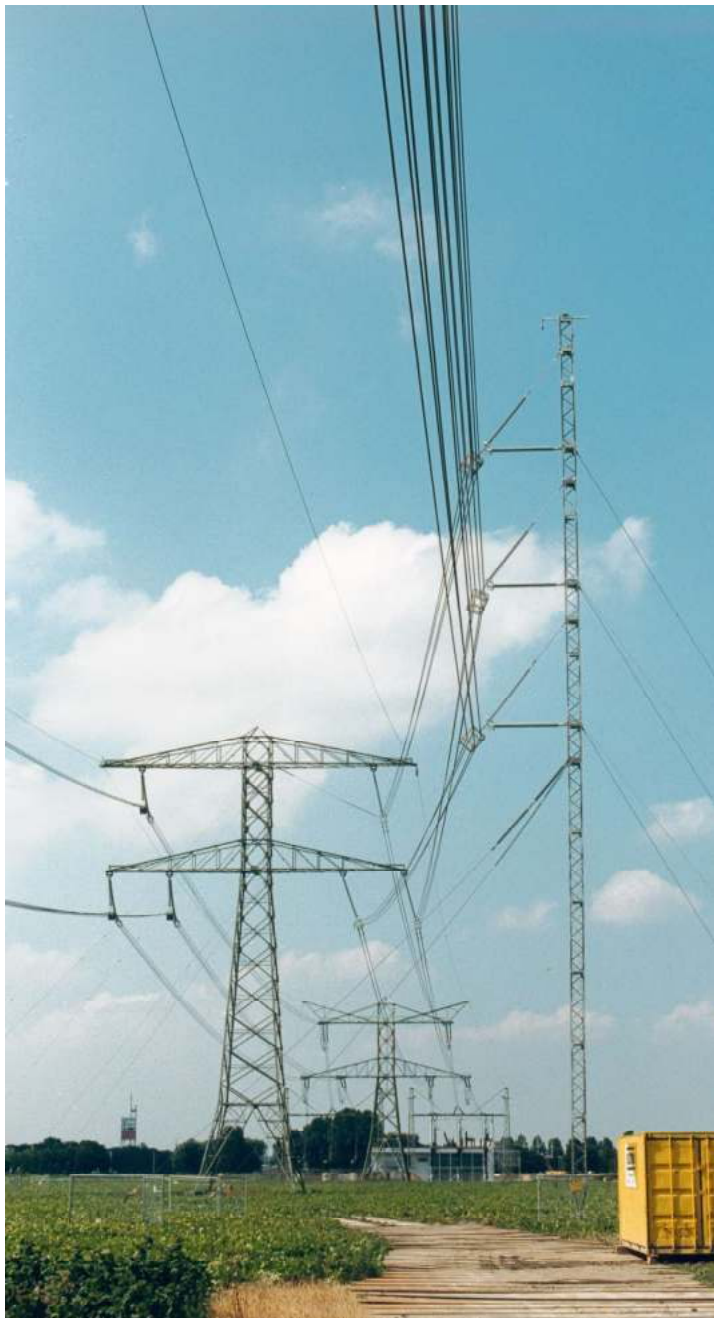
GRID CAPACITY

Creating medium- to long-term transmission lines to boost grid capacity. In sensitive locations where the regulatory process makes permanent transmission lines difficult or impractical. Our ERS towers have been erected to relieve system constraints for multiple years at a time.



Unique hoisting tower

Our hoisting tower allows building the ERS tower from bottom up, so working at height is minimized and limited only to a few meters above ground. DNV is the only supplier using its unique hoisting tower system.



A tower of 30 metres high, using 10 mast sections, can be fully erected with the insulators in four hours: without a crane. The hoisting tower can be set up in areas where cranes or heavy vehicles cannot come.

No heavy equipment required

With a maximum weight of 140 kilogrammes per section and a required workspace of 16 m², the hoisting tower comes on its own, together with the craftsmen. The hoisting tower can be set up manually and requires no heavy equipment. As the tower is secured to the same guy wire anchors that will be used for the tower itself, it saves construction time too.

Straightforward and intuitive

Just two days of training is all field crews need to be able to use the hoisting tower system to erect the towers. The hoisting tower builds the tower from the bottom up, minimising operating at heights and limiting it to four metres above ground level.

As with the ERS towers themselves, each hoisting tower, along with the required power tools, hand tools and accessories, is delivered in its own 20-foot shipping container.



Supporting software

The design of a transmission line is complicated and requires highly skilled engineers and the use of dedicated software.

Our ERS software tool named KELSOP, reproduces the main functionality of PLS-CADD, but has been stripped to the bare essentials required to set up the DNV emergency transmission line. KELSOP is DNV's custom-made software for ERS to make planning of the restoration route as quick and easy as possible. KELSOP was created with non-expert users in mind - so that they can quickly plan emergency lines when time is of essence - either in the field or in the office.

Practical and easy to use

Unlike traditional line engineering tools, the essentials of operating KELSOP can be mastered with a one-day of training. KELSOP, outputs assembly drawings of the towers, positions of the guys and the mechanical stresses in the towers.

The cloud-based programme's intuitive and easy-to use interface gives maximum flexibility to the end user. No engineering or consultancy firm is required to operate the software. A one-day training course is all that is required. All calculations for a safe restoration scenario are done by the KELSOP programme: the specific loading parameters are incorporated in the software.

DNV has added conductor types and characteristics into the programmes database. This ensures ease of use of the programme. The tower-type data sets are pre-defined between the customer and DNV and are non-configurable (within KELSOP) and they are the foundation on which calculations for the systems are based.

KELSOP has been modified and is now cloud-based. It includes the ability to directly import GPS data and satellite imagery. KELSOP is also compatible with iOS and can be used on-site remotely.

KELSOP generates the following output:

- route overviews (top view and side views)
- assembly drawings of the towers
- positions of the guy-wires
- calculation and approval of results for the mechanical loads on all the towers. Both the maximum permissible loads and the loads in the chosen situation are shown
- reports of the project starting points to be used as worksheets during the realization of the project



Transport and storage

The DNV ERS comes with brand new standard 20-foot seaworthy containers. Two complete towers, including insulators, guys, foundations and all other accessories, fit into one 20-foot container provided with a rack mount for storage of the all accessories. All sensitive parts are protected to avoid any damage.

We have a stowage plan for each container based on the chronological order in which the equipment is used during construction. Each container has a parts list and the containers are marked at the outside with the container number, and tower number and type to support inventory checks and transportation to site.

Each basic tower storage system consists of two distinct shelving units comprising an insulator rack and a corona ring rack, making it easier to check that all parts are at hand and stored safely, mitigating the risk of deformation and damaging.





ABOUT DNV

We are the independent expert in risk management and assurance. Driven by our purpose, to safeguard life, property and the environment, we empower our customers and their stakeholders with facts and reliable insights so that critical decisions can be made with confidence. As a trusted voice for many of the world's most successful organizations, we use our knowledge to advance safety and performance, set industry benchmarks, and inspire and invent solutions to tackle global transformations.

In the energy industry

We provide assurance to the entire energy value chain through our advisory, monitoring, verification, and certification services. As the world's leading resource of independent energy experts and technical advisors, we help industries and governments to navigate the many complex, interrelated transitions taking place globally and regionally, in the energy industry. We are committed to realizing the goals of the Paris Agreement, and support our customers to transition faster to a deeply decarbonized energy system.