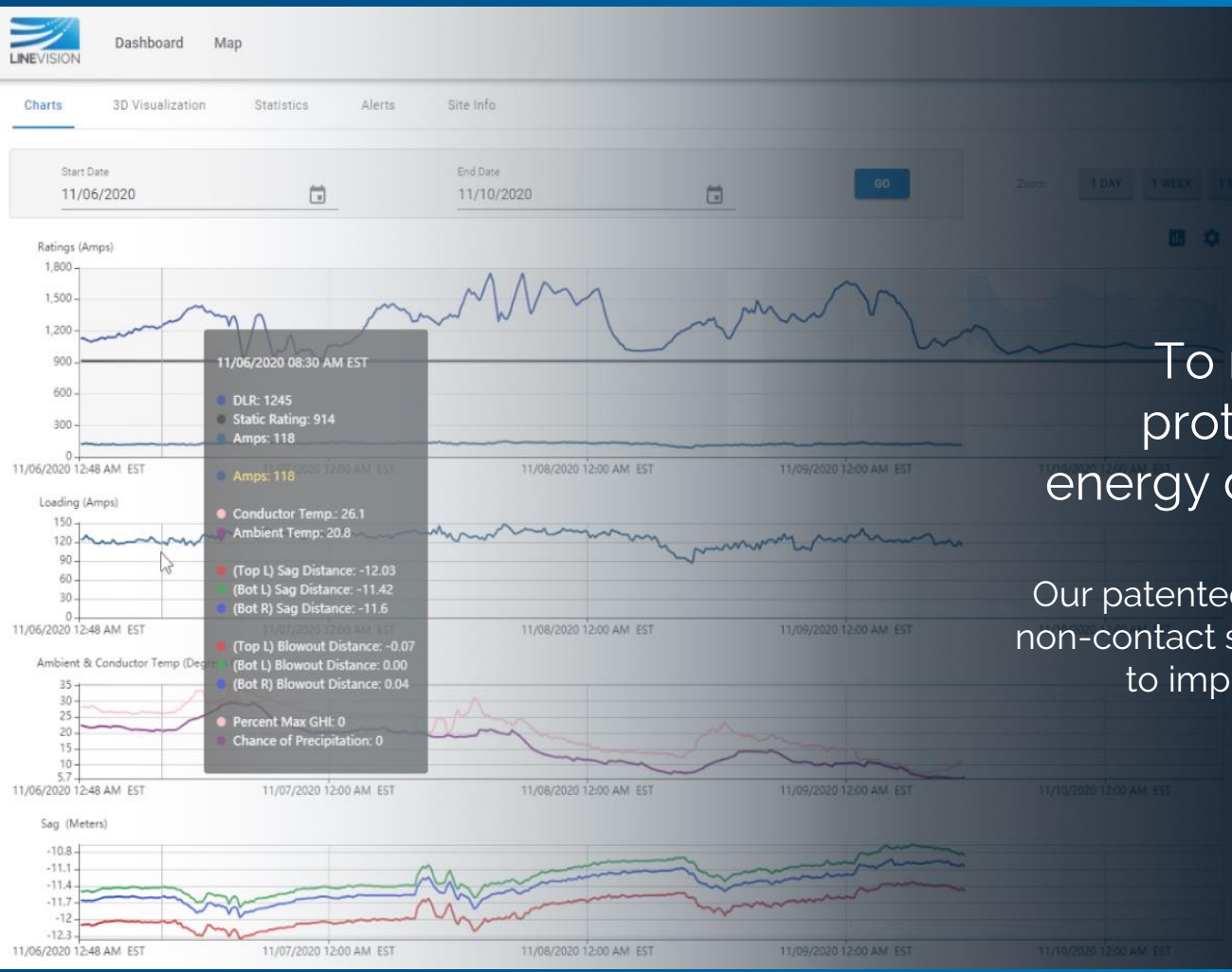

LINEVISION



LineVision

To monitor, optimize, and protect the world's critical energy delivery infrastructure.

Our patented monitoring solutions combine non-contact sensors and advanced analytics to improve the reliability, capacity and flexibility of lines.

LineVision V3 Technologies

Non-Contact LiDAR & EMF Sensors

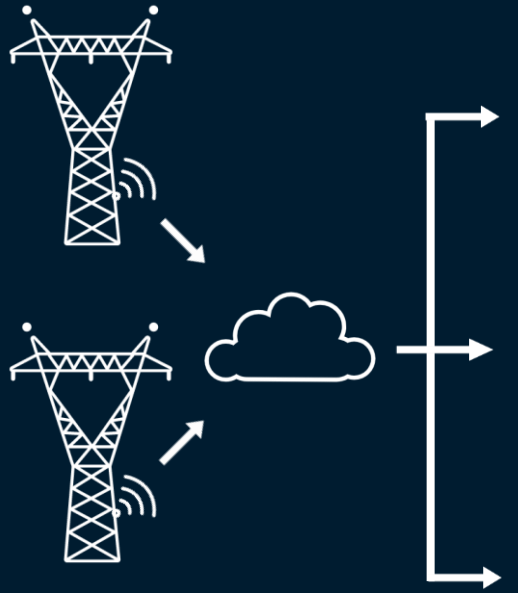
Patented Technology:
> EMF Power Flow Monitoring
> Non-Contact Conductor Position Monitoring

Scanning LiDAR:
> Continuously measures conductor position
> Cloud analytics power advanced insights

Removing Barriers to Adoption

- No outages
- No live-line work
- No destructive testing
- Data on ALL conductor phases
- Any tower, any voltage, anywhere

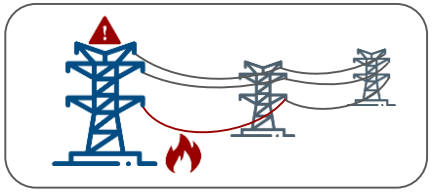
One Platform - Multiple Value Solutions



LineAware

Situational Awareness

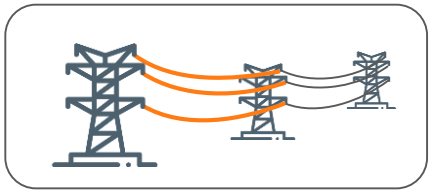
Inform operators with clearances and horizontal motion data, triggering alerts on exceedances.



LineRate

Dynamic Line Ratings

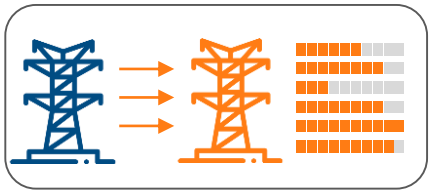
Increase the capacity on lines with Forecasted and Real-Time Dynamic Line Ratings (DLR).



LineHealth

Asset Health Monitoring

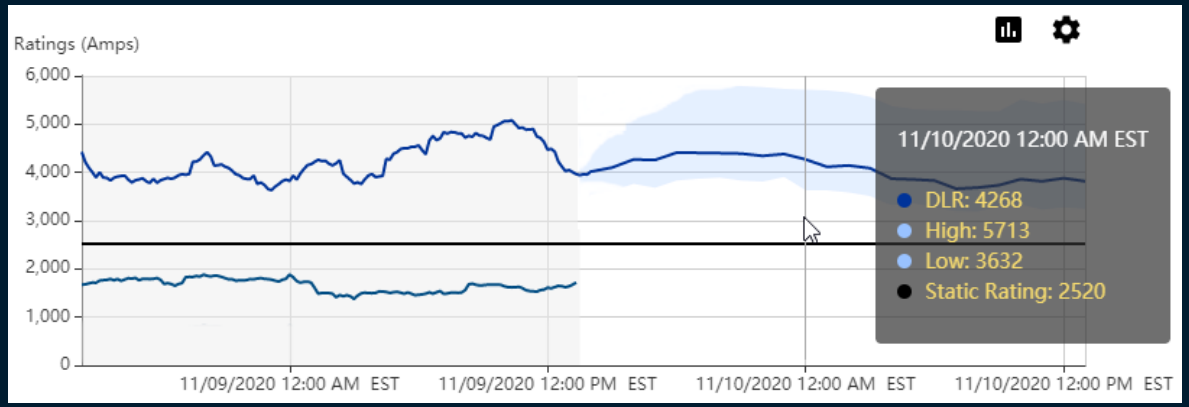
Improve maintenance strategies by creating a digital twin to determine conductor health.

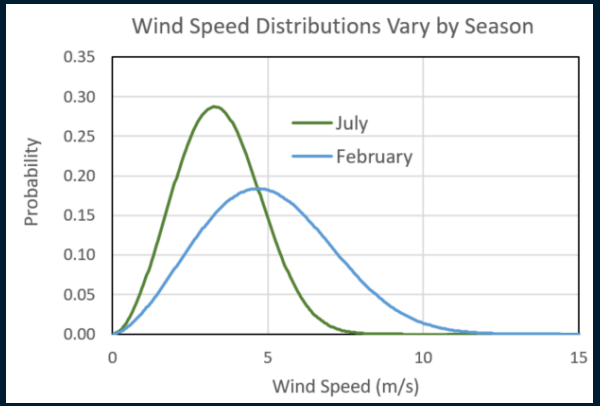


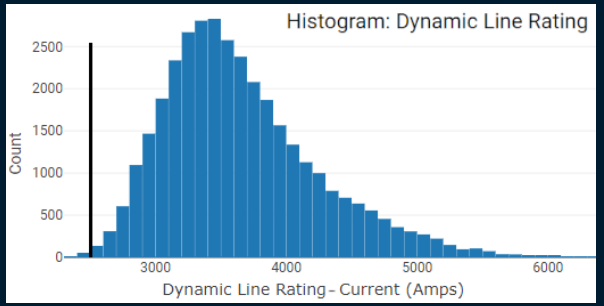
LineRate - Forecasted Line Ratings

Forecasted DLRs are computed using weather forecast data that are:

- Customized for the monitored line segment
- Tuned/trained by LineVision real-time monitoring data







Weather forecast data are analyzed for diurnal and seasonal trends

Forecasted Ratings are delivered with customizable Confidence Intervals

LineRate – Short Term Emergency (STE) Ratings

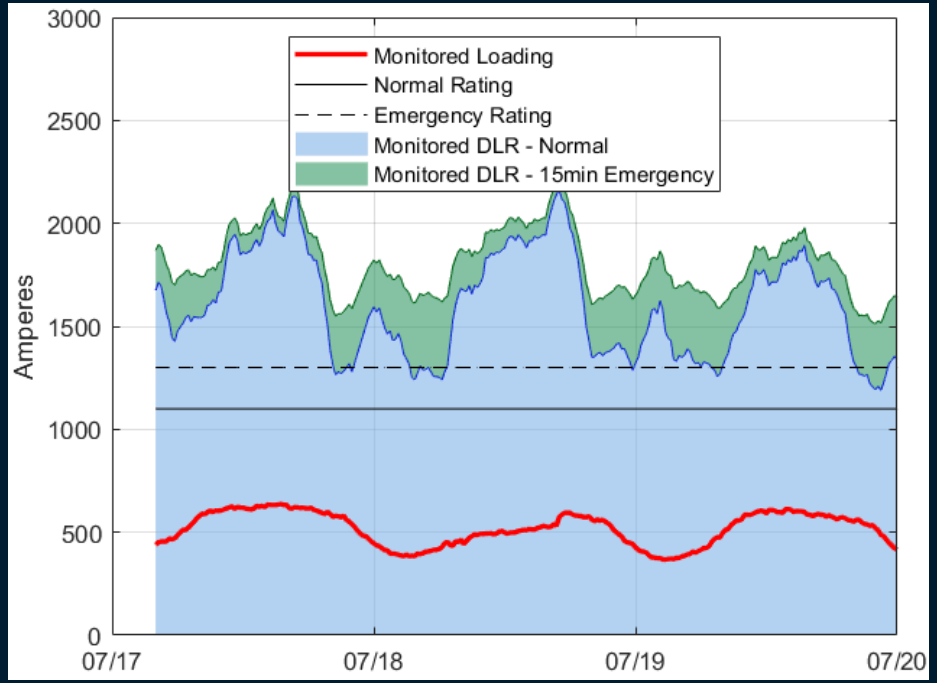
Real-time monitoring of loading and conductor temperature allows for Dynamic Short-Term Emergency operating limits.

Pre-contingency conductor temperatures and loadings are typically lower than worst-case assumed pre-load conditions.

In practice, the conductor has more “thermal headroom” that can provide the operator:

- more time to respond
- additional capacity during the response period

STE Ratings can be tailored to utility specific time requirements

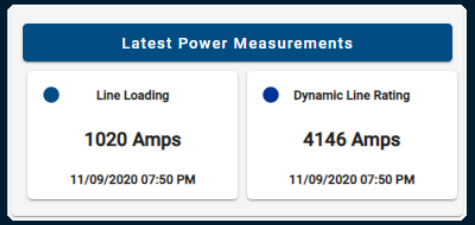


Additional STE Capacity Headroom Show in Green

Partnership Process

Scoping is a collaborative process to right-size the # of V3 systems and locations
- > Stringing Sections
- > Topography
- > Limiting Elements

Secure Data Integration
- > LineVision Data Portal
- > RESTful API
- > OSIsoft Message Format
- > ICCP, IEC 61850, etc.



PJM/LineVision/AEP 2018 CIGRE Paper [1]

All $11.1 M of congestion on the target line was eliminated with DLR.

However, downstream circuits saw an increase in congestion, resulting in a net of $4.2M of congestion reduction.

Recommendation: Equip multiple circuits in a congested area with DLR.

- [x] **Pilot Projects & Studies**
- [ ] **Realize the financial and operational benefits of DLR**

Total Annual Congestion			
Circuit	Base Case	DLR Case	Congestion Savings
Target Circuit 500 kV	$ (11,118,805)		$ 11,118,805
Target Circuit Transformer 500/230 kV	$ (10,011,856)	$ (9,780,911)	$ 230,945
Downstream 230 kV	$ (20,386,483)	$ (22,773,039)	$ (2,386,555)
Downstream Reactor 230 kV	$ (13,491,444)	$ (16,180,653)	$ (2,689,209)
Downstream Reactor to next Circuit 230 kV	$ (1,145,829)	$ (2,492,945)	$ (1,347,115)
Next Downstream Circuit 230 kV	$ (2,867,503)	$ (3,336,319)	$ (468,816)
Next Downstream Circuit 230 kV	$ (19,570,723)	$ (19,824,341)	$ (253,619)
			$ 4,204,436

1: S. Murphy, N. Dumitriu, N. Pinney, J. Marmillo. B. Mehraban, "Simulating the Economic Impact of a Dynamic Line Rating Project in a Regional Transmission Operator (RTO) Environment," CIGRE US National Committee 2018 Grid of the Future Symposium.

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