

# Pretact® – React in advance. Grid resilience along the entire energy value chain

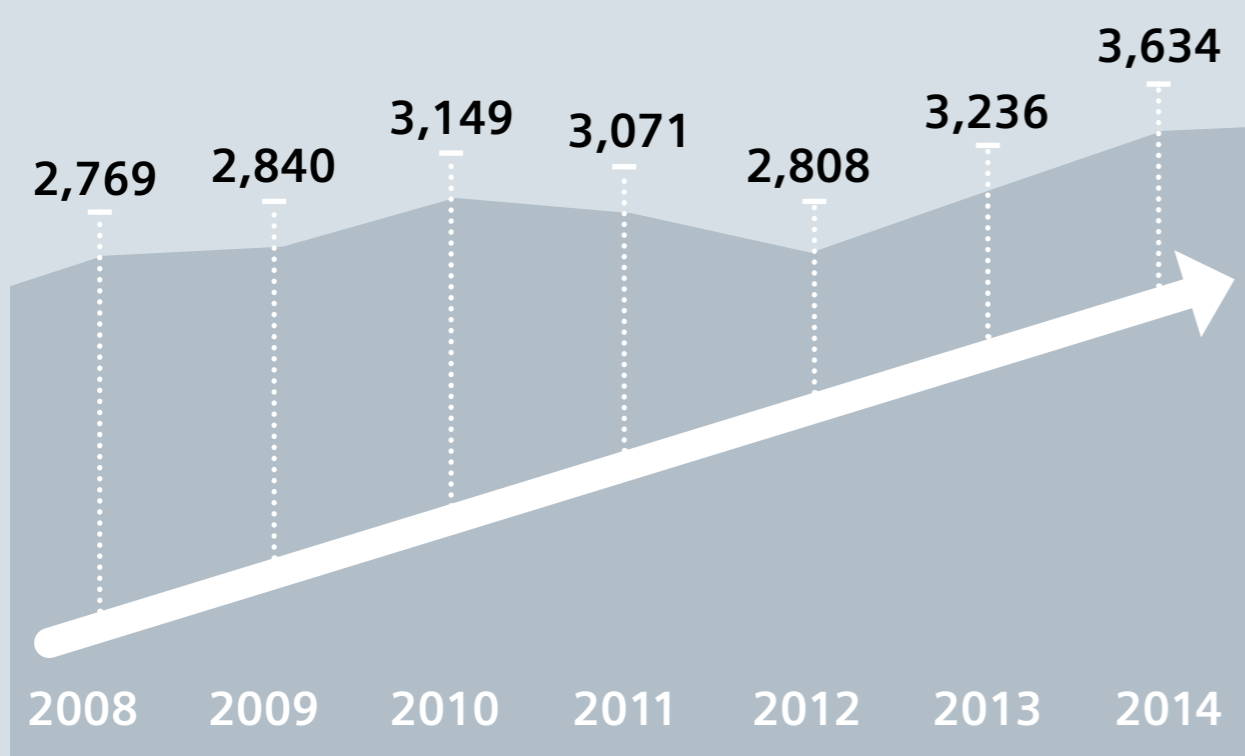
## Power Transformer Case

**!** The problem: ageing assets in a strained grid infrastructure

A large portion of the installed power transformers within the U.S. were installed in the 1950s, 60s and 70s and are now reaching the end of their projected service life.



## Example: Power outages in the U.S.



As a result, power outages in the U.S. are becoming increasingly more frequent and it is feared that their number will continuously increase as equipment ages.

## Causes of transformer failures in the U.S.

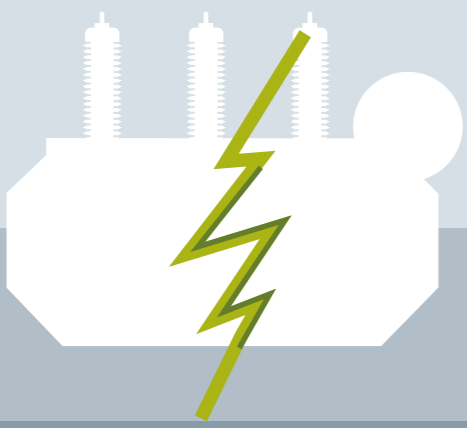
- 28%** Electrical disturbances
- 27%** Other
- 13%** Lightning
- 9%** Insulation
- 6%** Electrical connection
- 4%** Overload
- 4%** Foreign objects
- 4%** Moisture
- 3%** Line disturbance
- 2%** Stress or fatigue

Most power transformers fail in operation, but natural disasters and other forced outages do occur and harm the equipment.

**!** More than half the power transformer outages are due to electrical disturbances, natural disasters (e. g. lightning), insulation failures, and other forced impacts.

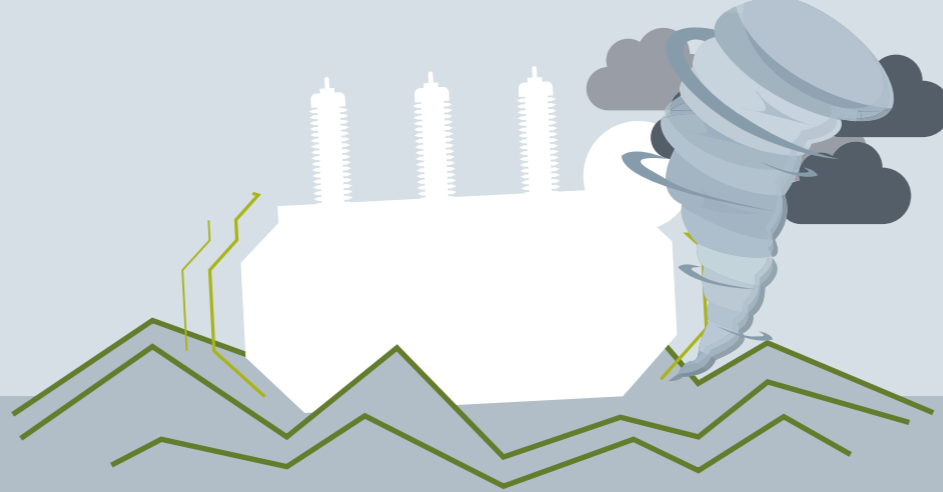
## Risk factors for grid resilience

### Operational issues



- Network failures
- Incorrect operations
- Aged fleet
- Load balancing

### Natural disasters



- Earthquakes
- Hurricanes
- Flooding
- Fire
- Geomagnetic storms

### Other forced outages



- Physical impacts
- Cyber impacts

## Pretact® – Siemens grid resilience concept

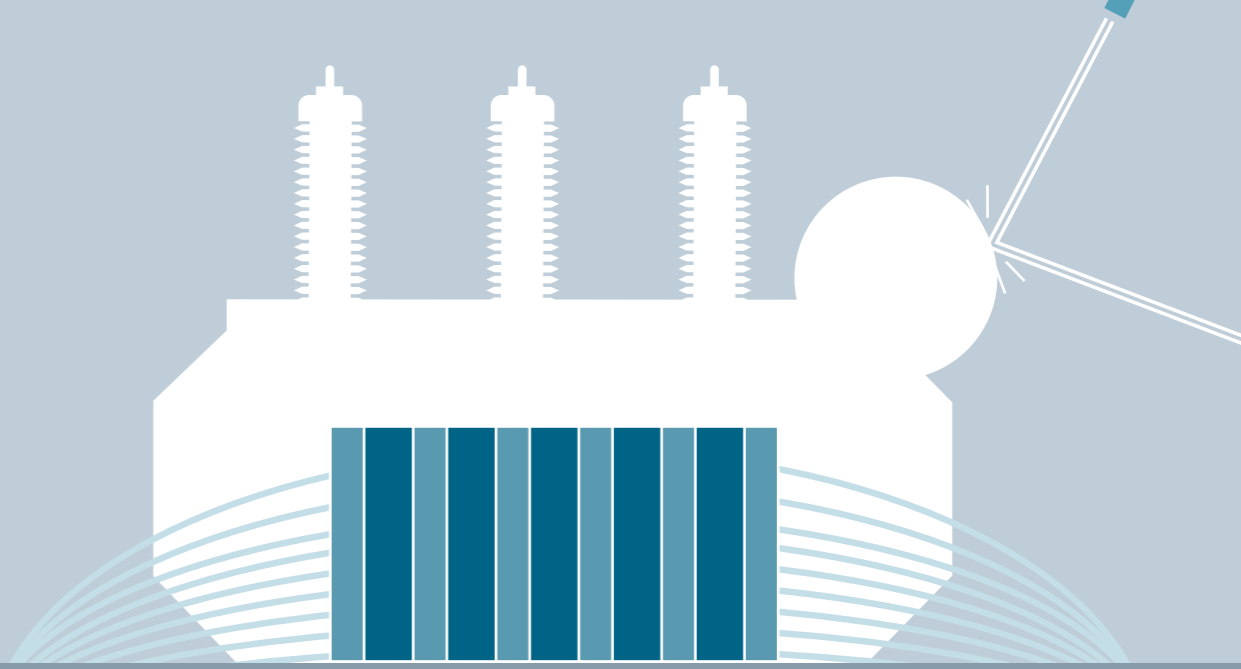
Most of the aged transformers will need to be replaced by standard power transformers. However, there is a strategy beyond replacement. Siemens Transformers' cutting edge concept gives operators peace of mind.

### Prevent operational risks



- Transformer Lifecycle Management
- Condition Monitoring
- Repair and Retrofit
- Prevent component failures (e.g. Bushing service)
- Long Term Program (LTP)

### Protect against forced impacts and excessive heat



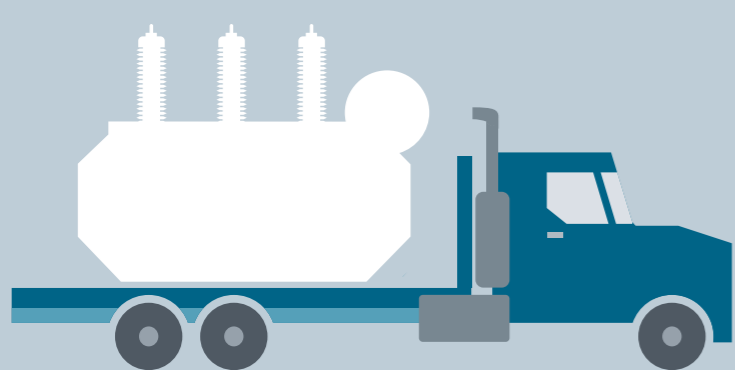
- GIC\*-safe transformers
  - Avoid critical heating
  - Up to 200 A extra DC-capacity
  - Non-magnetic steel inserts prevent overheating

\* Geomagnetically induced current

- Bullet resistant transformers
  - Special shielding with bullet-proof materials up to Cal.50 Ball M2 for new transformers and as an upgrade for existing units

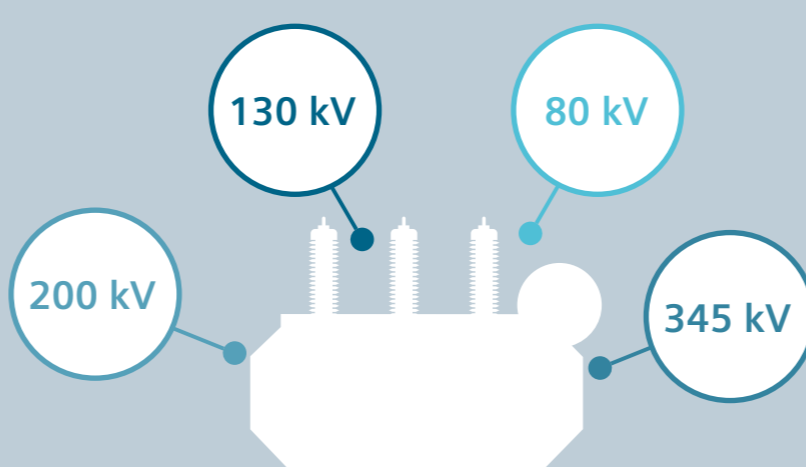
### React to emergencies

#### Mobile



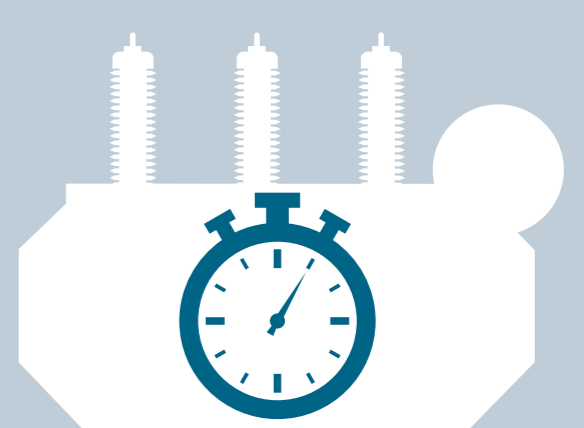
Compact & lightweight design

#### Versatile



Covering different ratings

#### Rapid installation



Plug & play connections and bushings

Long term service agreements for storage, transport and maintenance of spare units.