FuseSaver

Highest availability and cost savings for your medium voltage distribution network
Challenges for rural networks
Characteristics of MV power distribution networks

1. Overhead networks
   - Radial network
   - Long line lengths
   - Few customers
   - Difficult to access

   \(\rightarrow\) little revenue, but costly to own and operate!

2. Main fault causes
   - Vegetation / Veld fires
   - Wild life
   - Lightning
   - Wind
   - Vandalism
   - Fault characteristics
     - Temporary faults
     - Low fault currents

3. Reliability challenges
   - Long drive or flight time
   - Long time to find faulted spur
   - Patrolling line to find fault (or not)
   - Limited communication
   - Poor data feedback from the field
   - Long outage times

4. Consequences
   - Poor reliability (SAIDI, SAIFI, MAIFI, etc.) causes financial penalties
   - High operating costs
   - Increasing costs to provide meaningful reliability data to the regulator
Challenges for rural networks
A typical rural network example

In most network configurations, the feeder is protected by a circuit breaker (CB) or Auto-Recloser (ACR).

Spur lines* are usually protected by fuses.

Categorization of measured faults in MV Power Distribution Networks

- no fault
- temporary fault \( \sim 80 \% \)
- permanent fault \( \sim 20 \% \)

* also referred to as T-offs or laterals
Necessity of cost saving (material, personnel, penalties)

1. Fuses are needlessly damaged!
   + material costs
2. Line crews spend time to detect the fault and replace the fuse!
   + personnel expenses
3. Downstream users are left without power . . .
   + potential penalty payments

80 % of a network’s faults are temporary . . .
Traditional Spur line protection

Cut-out Fuse

**Benefits**
- Cheap - $100 / phase
- Relatively reliable
- Visible break
- Isolation

**Limitations**
- Operates on transient faults
- Can jam during operation
- No data
- No remote control

Drop-out Sectionalizer

**Benefits**
- Sectionalizes faulted spur line*

**Limitations**
- Requires upstream Recloser dead time to operate
- Water ingress and seizing when operating
- No data
- No SCADA

* also referred to as T-offs or laterals
Spur line protection solution
Siemens FuseSaver

- CB
- CB
- CB
- CB
- ACR
- ACR
- FS
- FS
- FS

- no fault
- temporary fault ~ 80%
- permanent fault ~ 20%
The Solution – The FuseSaver

The Siemens FuseSaver...

1. ... single-phase fault interrupting device that prevents a fuse from blowing on transient faults
2. ... is connected in series with a fuse, is self powered and easy to install
3. ... is capable of detecting, opening and clearing a fault in a half cycle
4. ... is primarily targeted at providing protection and automation of low fault level lines
5. ... creates the benefits of improved network reliability and reduced maintenance callouts
6. ... completely encapsulated featuring vacuum switching technology
The fuse protects the spur line from temporary and permanent faults . . . but it needs to be replaced!
The fuse protects the spur line from permanent faults and... the Siemens Fuse Guard protects the fuse from being blown by transient faults.
The fuse protects the spur line from permanent faults and . . . the Siemens Fuse Guard protects the fuse from being blown by transient faults.
# Performance Comparison

<table>
<thead>
<tr>
<th>Performance Capability</th>
<th>Fuse</th>
<th>Sectionalizer</th>
<th>FuseSaver</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improve operator safety</td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>Interrupt Fault Currents</td>
<td>YES</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>Only spur line customers affected by fault</td>
<td>YES</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>Transient faults only cause momentary outage</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Point of visible isolation of the line</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Visible indicator of permanent fault on line</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Provides data on fault and line operation</td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>Communicate location of fault</td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>Event history for the line</td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>SCADA integration</td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
</tr>
</tbody>
</table>
Siemens FuseSaver
Introduction: Product overview

<table>
<thead>
<tr>
<th>Product overview</th>
<th>12 kV</th>
<th>15.5 kV</th>
<th>24 kV</th>
<th>27 kV</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rated voltage</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fuse ratings</td>
<td>Up to 50 A</td>
<td>Up to 50 A</td>
<td>Up to 16 A</td>
<td>Up to 50 A</td>
</tr>
<tr>
<td>Rated indefinite overload current</td>
<td>100 A</td>
<td>100 A</td>
<td>32 A</td>
<td>100 A</td>
</tr>
<tr>
<td>Rated short-circuit breaking current</td>
<td>4 kA RMS</td>
<td>4 kA RMS</td>
<td>1 kA RMS</td>
<td>4 kA RMS</td>
</tr>
<tr>
<td>Rated short-circuit making current</td>
<td>10 kA peak</td>
<td>10 kA peak</td>
<td>2.5 kA peak</td>
<td>10 kA peak</td>
</tr>
<tr>
<td>Rated lightning impulse withstand voltage</td>
<td>75 kV</td>
<td>110 kV</td>
<td>125 kV</td>
<td>125 kV</td>
</tr>
<tr>
<td>Minimum line current for operation</td>
<td>0.5 A</td>
<td>0.5 A</td>
<td>0.15 A</td>
<td>0.5 A</td>
</tr>
<tr>
<td>Fault break operations at 100 %</td>
<td></td>
<td></td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Minimum tripping current (configurable)</td>
<td></td>
<td></td>
<td>x 2 fuse rating</td>
<td></td>
</tr>
<tr>
<td>Mechanical operations</td>
<td></td>
<td></td>
<td>2,000</td>
<td></td>
</tr>
<tr>
<td>Rated frequency</td>
<td></td>
<td></td>
<td>50/60 Hz</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td></td>
<td></td>
<td>5.5 kg</td>
<td></td>
</tr>
</tbody>
</table>

**Parameters**

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<thead>
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<th></th>
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<tbody>
<tr>
<td>Maximum operating ambient temperature</td>
<td>+50 °C</td>
</tr>
<tr>
<td>Minimum operating ambient temperature</td>
<td>-30 °C</td>
</tr>
<tr>
<td>Solar radiation</td>
<td>1.1 KW/m²</td>
</tr>
<tr>
<td>Maximum altitude</td>
<td>3000 m</td>
</tr>
<tr>
<td>Humidity</td>
<td>0 to 100 %</td>
</tr>
</tbody>
</table>
FuseSaver – Benefits

**Handling**
- Lightweight (5.5 kg)
- Fast and easy installation – plug and play
- No change in protection scheme needed
- Simple line installation
- Safety benefits for live-line crew thanks to half-cycle switching

**Technology**
- Smart grid-ready with communications module
- Highly integrated and innovative technology
- Protection, monitoring, metering, and control in a single unit
- Self-powered
- Half-cycle switching – fastest vacuum circuit breaker on the market
FuseSaver – Benefits

Costs
- Typical return on investment is less than two years
- Improved network reliability means fewer penalty payments for
  - SAIFI, SAIDI etc.
- Reduced operating costs thanks to reduced maintenance callouts