EBM
Innovative Cost Effective T&D Solutions

WELCOME
Improving the reliability performance of medium voltage networks the business case

*Presenter: Roger Martin (EBM)*
IntelliRupter Pulse Closer

A) Six Integrated voltage sensors providing highly accurate sensing. Integrated current sensors provide extremely flat response, from low-level load currents through fault current levels, ensuring reliable measurements critical for system analysis.

B) Integrated pole mounting brackets designed for single point of lift and quick and easy installation.

C) Integral power module fed from one or both sides and different phases to maximise availability of control power. Eliminates cost and complexity of seperately mounted transformers.

D) Integrated disconnect provides visible air gap isolation for dead-line work and facilitates operational testing. Mechanically interlocked with interrupters.

E) Very simple field operation via a single open/close/locked open lever.

F) Integral Controls features hookstick-removable control and communication modules.

G) Stainless-steel base provides outstanding corrosion-resistance, even in the harshest environments.

H) Vacuum Interrupter open/closed indicator.
Reclose - Normal Speed
IntelliRupter Installation
S&C TripSaver II
TripSaver II Installation
Benefits: Tripsaver II

**Benefits:**
- **Low lifetime Costs**
  - Potential Network Operating Cost Reduction
- **Reliability**
  - Improve the reliability of critical lateral circuits targeting to reduce SAIDI & SAIFI
- **Customer Service**
  - Less outages than fuses. Less momentary interruptions than sectionalizers (MAIFI)
- **Environmental**
  - Less distance driven. Lower fuel costs. Lower carbon emissions. Less environmental impact
- **Safety**
  - Fault finding using expulsion fuses can be dangerous. Less time driving
S&C TripSaver II – Temporary Fault

![Graph showing current and time relationship for IAC77 640A, TD7 with two shots: 1st Shot (fast) and 2nd Shot (slow)].

- **Current (Amperes)**: 0.01, 0.1, 1, 10, 100, 1000, 10000
- **Time (seconds)**: 100, 1000, 10000
- **IAC77 640A, TD7**
  - 1st Shot (fast)
  - 2nd Shot (slow)
S&C TripSaver II – Temporary Fault

![Graph showing current and time relationship for a fault]

- **IAC77 640A, TD7**
- **2nd Shot (slow)**
- **1st Shot (fast)**

![Electrical diagram showing a system with a fault]

- **Current (Amperes)**
- **Time (seconds)**
S&C TripSaver II – Temporary Fault

![Graph showing current and time with labels for 1st Shot (fast) and 2nd Shot (slow) with IAC77, 640A, TD7 specifications.]
S&C TripSaver II – Permanent Fault

![Diagram showing current (amperes) vs. time (seconds) for IAC77 640A, TD7 with 1st Shot (fast) and 2nd Shot (slow).]
S&C TripSaver II – Permanent Fault

![Graph showing current (Amperes) against time (seconds) for 1st and 2nd shots.]

- **IAC77 640A, TD7**
- **1st Shot (fast)**
- **2nd Shot (slow)**
S&C TripSaver II – Permanent Fault

Current (Amperes) vs. Time (seconds) for IAC77 640A, TD7

- 1st Shot (fast)
- 2nd Shot (slow)
S&C TripSaver II – Permanent Fault

[Graph showing current (amperes) vs. time (seconds) with labels 1st Shot (fast) and 2nd Shot (slow).]

IAC77 640A, TD7

1st Shot (fast)

2nd Shot (slow)
WaterKloof Feeder Statistics

PILOT FEEDER FAULT FREQUENCY STATISTICS - WATERKLOOF F1 11kV FEEDER
- number of unplanned faults (2008-2013)

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<tr>
<th>Year</th>
<th>Faults</th>
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<tr>
<td>2008</td>
<td>22</td>
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<tr>
<td>2009</td>
<td>37</td>
</tr>
<tr>
<td>2010</td>
<td>19</td>
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<tr>
<td>2011</td>
<td>23</td>
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<tr>
<td>2012</td>
<td>36</td>
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<tr>
<td>2013</td>
<td>18</td>
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<tr>
<td>Total</td>
<td>155</td>
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Costs Evaluation for the Different Solutions

<table>
<thead>
<tr>
<th>Configuration 1</th>
<th>Standard Eskom MV Network with fuses, disconnects and reclosers</th>
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<tbody>
<tr>
<td>Configuration 2</td>
<td>Configuration 1 + Fusesavers added at SF451</td>
</tr>
<tr>
<td>Configuration 3</td>
<td>Configuration 2 + Tripsavers and FPI’s added at SF617</td>
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<tr>
<td>Configuration 4</td>
<td>Configuration 3 + Intellirupter Pulsecloser added at LBS 4204</td>
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</table>

<table>
<thead>
<tr>
<th></th>
<th>Configuration 1</th>
<th>Configuration 2</th>
<th>Configuration 3</th>
<th>Configuration 4</th>
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</thead>
<tbody>
<tr>
<td>Power Factor (Cos θ)</td>
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<td>0.92</td>
<td>0.92</td>
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<tr>
<td>Load Factor</td>
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<tr>
<td>Customer type</td>
<td>Industrial / commercial</td>
<td>Industrial / commercial</td>
<td>Industrial / commercial</td>
<td>Industrial / commercial</td>
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<tr>
<td>Customer charges</td>
<td>80c/kWh</td>
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<td>Cost of unserved energy</td>
<td>R21.48/kWh</td>
<td>R21.48/kWh</td>
<td>R21.48/kWh</td>
<td>R21.48/kWh</td>
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<tr>
<td>SAIDI value using DlgSILENT</td>
<td>15.24</td>
<td>12.99</td>
<td>12.4</td>
<td>7.13</td>
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<tr>
<td>Utility cost</td>
<td>R 559 071.80</td>
<td>R 705 204.86</td>
<td>R 943 814.18</td>
<td>R 1 342 960.29</td>
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<td>Customer Interruption cost</td>
<td>R 2 967 336.00</td>
<td>R 2 702 229.90</td>
<td>R 2 639 026.32</td>
<td>R 1 659 123.89</td>
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<tr>
<td>Total cost</td>
<td>R 3 526 407.80</td>
<td>R 3 407 434.75</td>
<td>R 3 582 840.50</td>
<td>R 3 002 084.18</td>
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TripSaver II – Summary of Operations – Phase A

Below it can be seen the screen showing the Trip events for the unit under the serial number TCMR-0001413.

- Total number of open operations due to overcurrent: 5 (five)
- Number of drop-open due to overcurrent (lock-out due to permanent fault): 1 (one)
TripSaver II – Summary of Operations – Phase B

Below it can be seen the screen showing the Trip events for the unit under the serial number TCMR-0001414.

- Total number of open operations due to overcurrent: **8 (eight)**
- Number of drop-open due to overcurrent (lock-out due to permanent fault): **1 (one)**
TripSaver II – Summary of Operations – Phase C

Below it can be seen the screen showing the Trip events for the unit under the serial number TCMR-0001415.

- Total number of open operations due to overcurrent: 3 (three)
- Number of drop-open due to overcurrent (lock-out due to permanent fault): 0 (zero)
Business Case for use of Tripsaver II

Business Case based on ESKOM Pilot Results
Sept 2014 - May 2017

Assumptions
Duration of pilot (months): 33
Cost of truck roll: R 5,000
Number of customers: 6
Average load (kW): 345
Distribution tariff (R/kWh): R 15.37
Average time to restore (hrs): 3
Cost of TSII: R 32,750

A  Cost of TS II installation = R 103,250
B  Avoidance of temporary faults causing extended outages = 8
C  Truck roll cost = R 5,000
D  O&M cost saving = R 40,000
E  Avoided energy not supplied (kWh) = 49,680
F  Distribution tariff = R 15.37
G  Value of avoided energy not supplied = R 763,582
H  Total savings across pilot period = R 803,582
I  Savings per year = R 292,211
J  Payback period (years) = 0.35
TripSaver – Example of Operation
Conclusions

• Innovative solutions have a higher upfront cost but lower lifetime costs.

• A complete business case considering the costs of the interruption has to be made in order to drive the best investment decisions.
THANK YOU