



THE 21ST INTERNATIONAL
OPERATIONS & MAINTENANCE
CONFERENCE IN THE ARAB COUNTRIES

On-Line Monitoring and Measuring Partial Discharge & Temp For Dist. Equipment

    #OmaintecConf

An Initiative by

Organized by

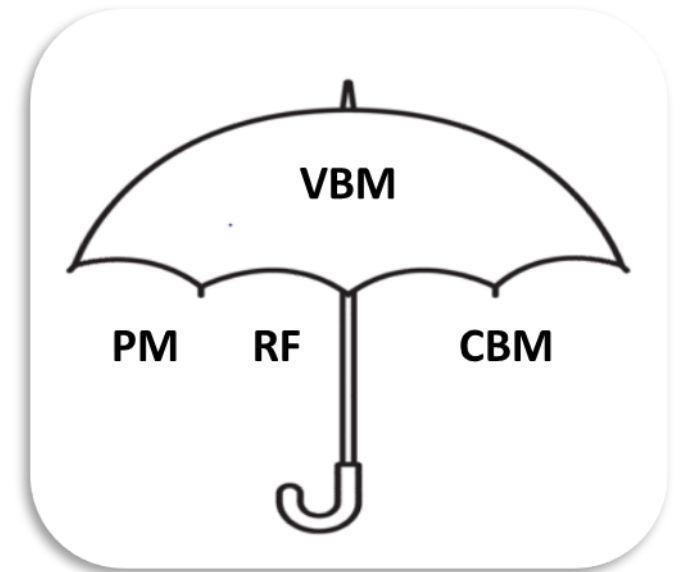


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Value Base Maintenance Definition

- ❑ It is one of the types of maintenance strategies, which includes all types of maintenance (Periodic maintenance – Condition Base maintenance – Run To Failure) by studying the current situation of network assets, maintenance costs and the impact of the maintenance period for each asset of the network

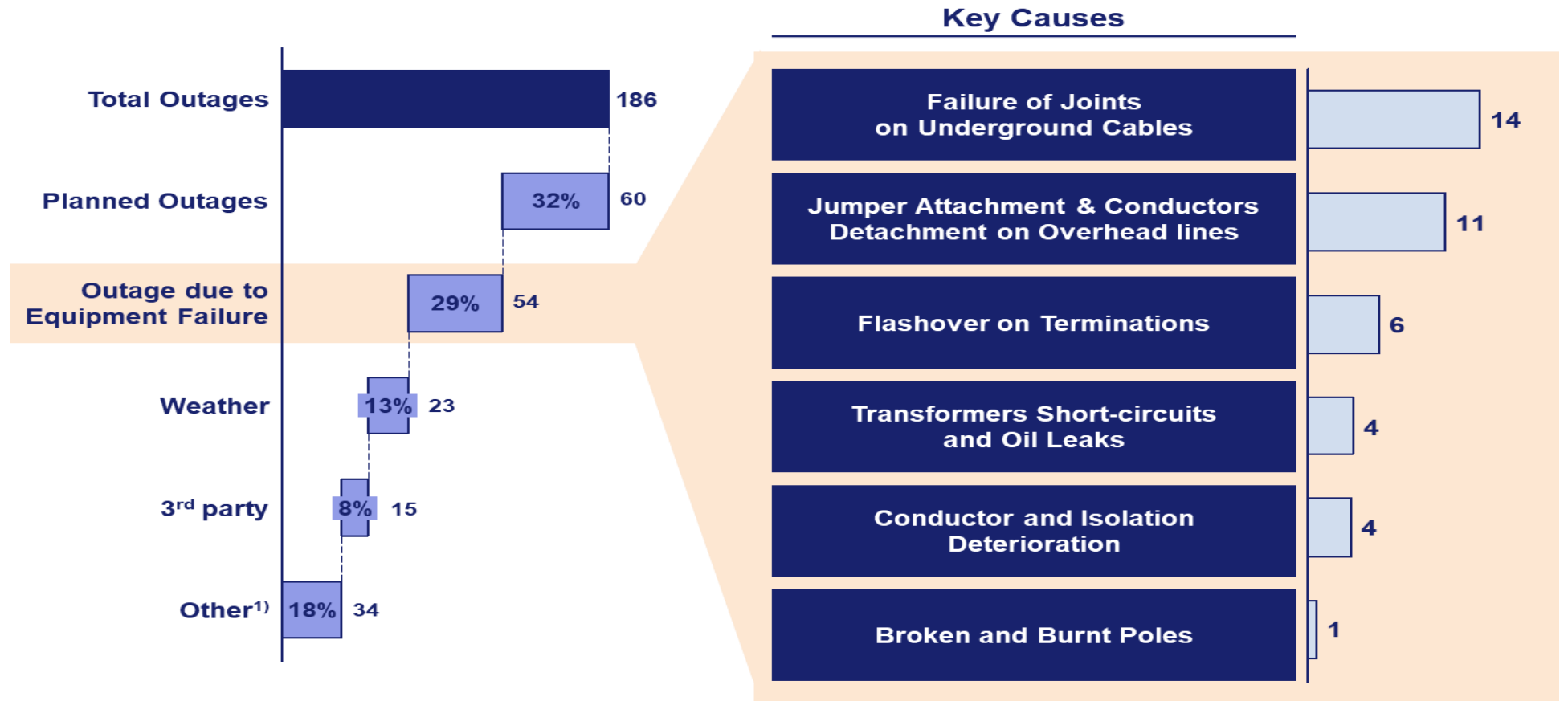
- ❑ Value Base Maintenance priority
 - 1- Cost
 - 2-Reliability
 - 3-Safety



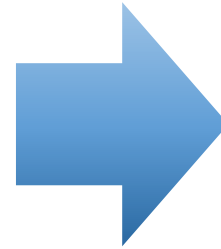
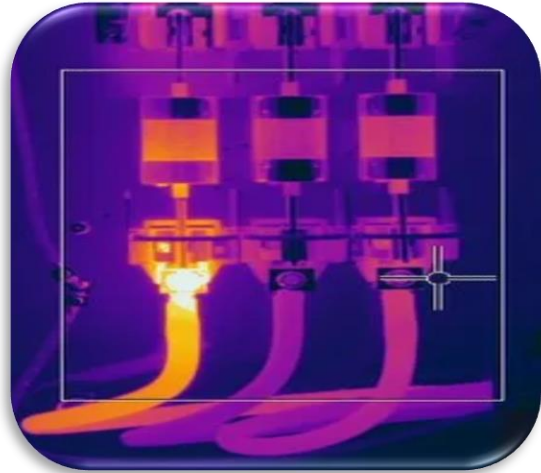


The main causes of failures

❑ Root cause analysis



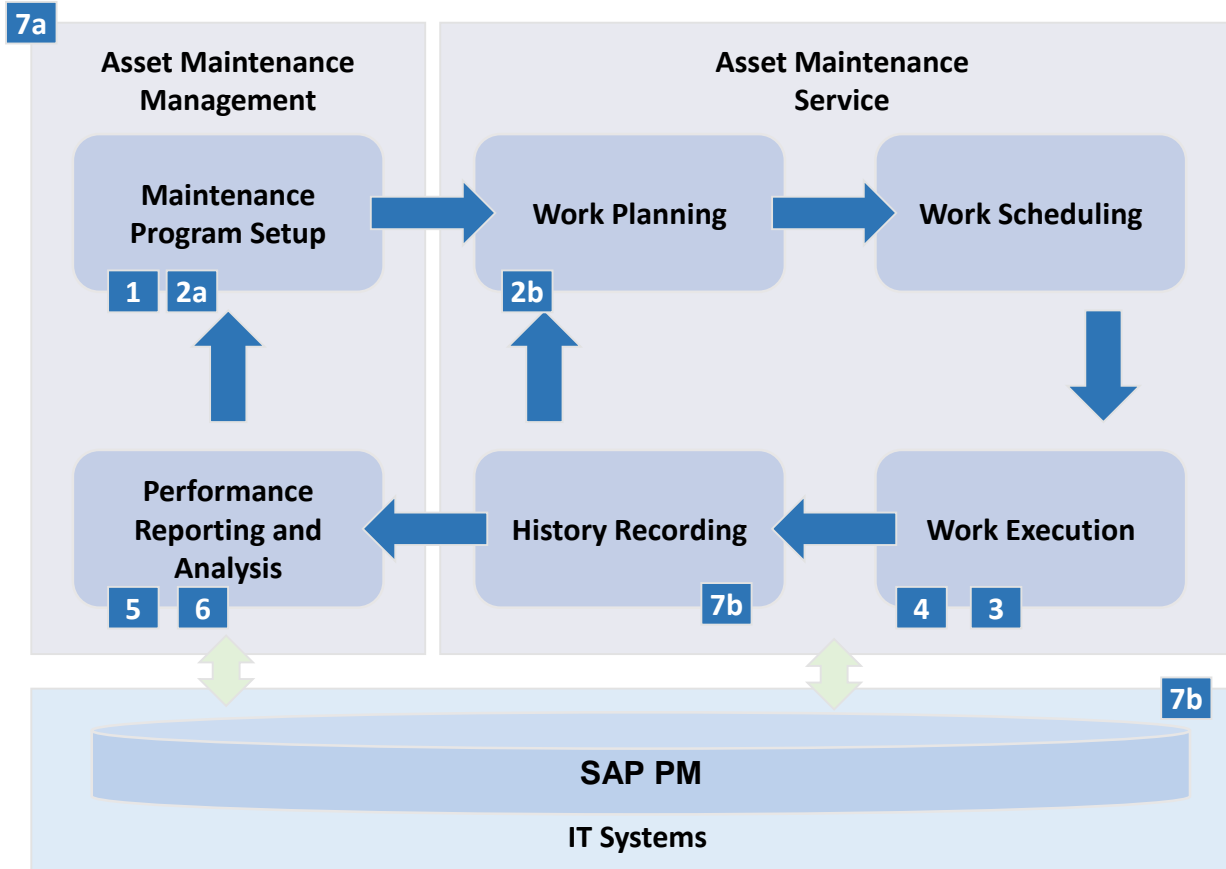
Outage due to Equipment's Failure





Outputs of the VBM initiative

Maintenance Management System



Strategic Maintenance Initiatives

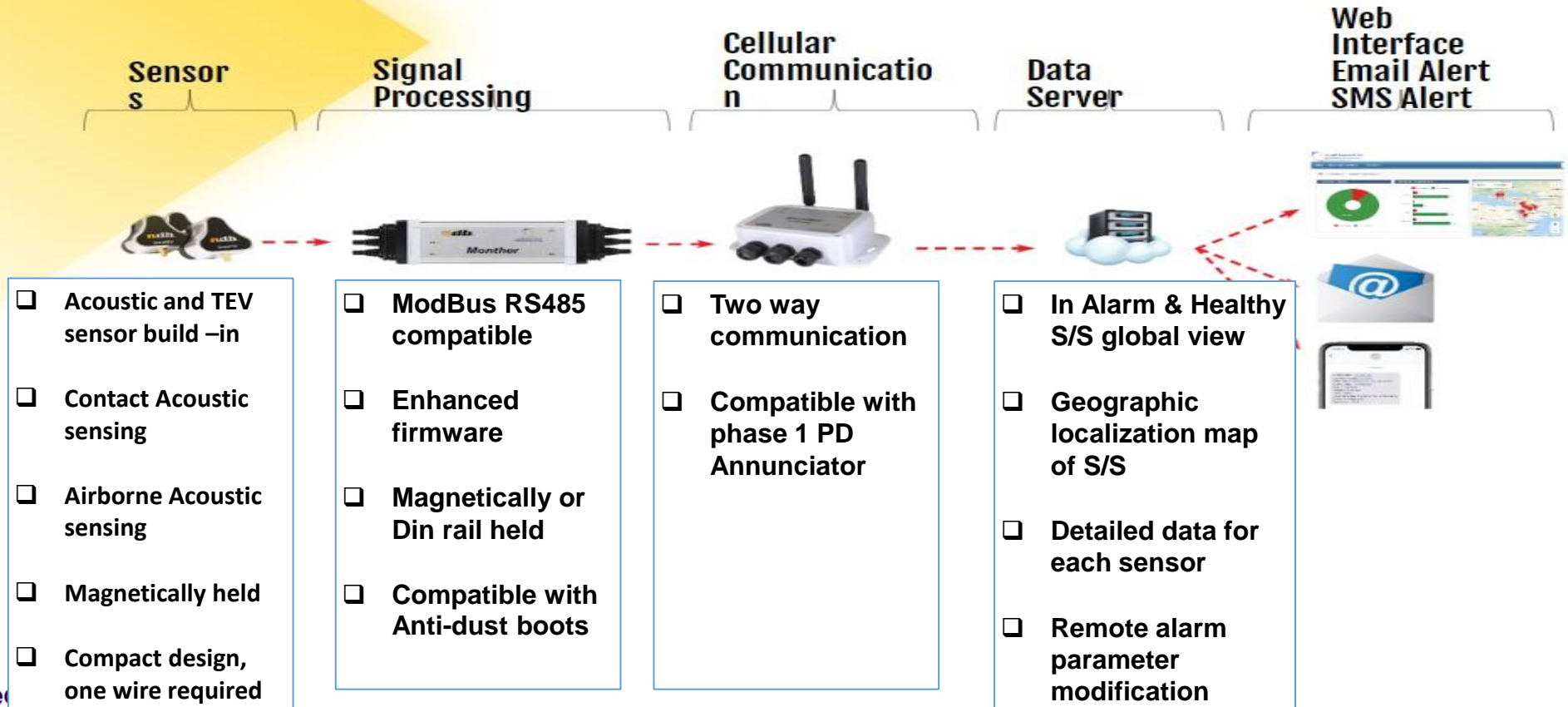
- 1 Improved Distribution & MDN Maintenance Manual
- 2 Maintenance Planning Guidelines
- 3 Cost/benefit Methodology for Life-cycle Management
- 4 **Advanced Asset Monitoring Systems**
- 5 Life-cycle Asset Management Performance System
- 6 Failure Resolution Manual
- 7 New Asset Life-cycle Management System Requirements

Partial Discharge System For RMU

- One of the Condition Monitoring technologies was analyzed. Several options were recommended for implementation is (**MONTHER**) for Ring Main unit in Dist. Network

Technology	Advantages	Disadvantages	Aggregated Impact	Recommended Action
<p>On-line PD monitoring</p>	<ul style="list-style-type: none"> Non-destructive technique Detects existence, severity and location of the problem 	<ul style="list-style-type: none"> Offline PD requires shut-down Online PD problematic on solidly bounded cables 	<p>On commissioning</p> <ul style="list-style-type: none"> SEC saving: + Customer saving: + SAIDI improvement: + <p>Feeders in operation</p> <ul style="list-style-type: none"> SEC saving: ++ Customer saving: ++ SAIDI improvement: +++ 	<p>Implement Online PD for new feeders</p> <p>Implement for bad performing feeders and where possible in combination with Online PD</p>

Monther Components



Monther Project History



PD Annunciator Module
Configurable system with open collector type alarm



SonoTEV sensor
Innovative sensor with TEV and Contact acoustic capabilities magnetically mounted



Power Supply / Communication
Power supply module with cellular communication capabilities for single alarm delivery only (on/off status)



PD Annunciator Module
Now Modbus RS485 compatible



SonoTEV sensor
Two models now available:
Standard SonoTEV
SonoTEV for airborne acoustic applications



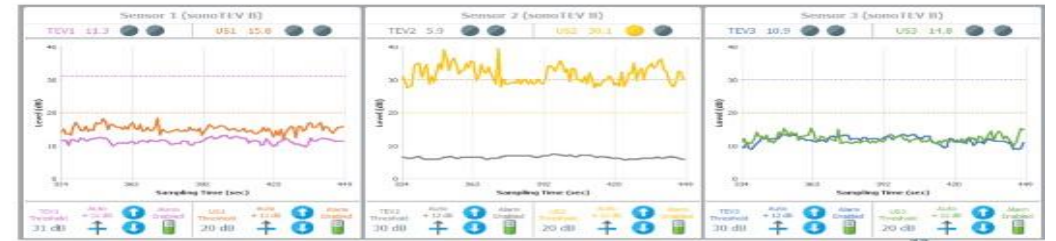
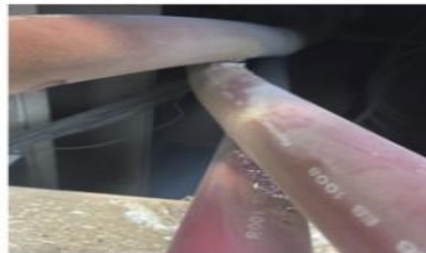
Power Supply / Communication
Two way cellular gateway
Detailed alarm information
Remote alarm configuration

Install MONTHER in 50 RMU

Install MONTHER in 430 RMU

SEC Substation 10390

- Partial discharge alarm sent by email
- Onsite investigation confirmation



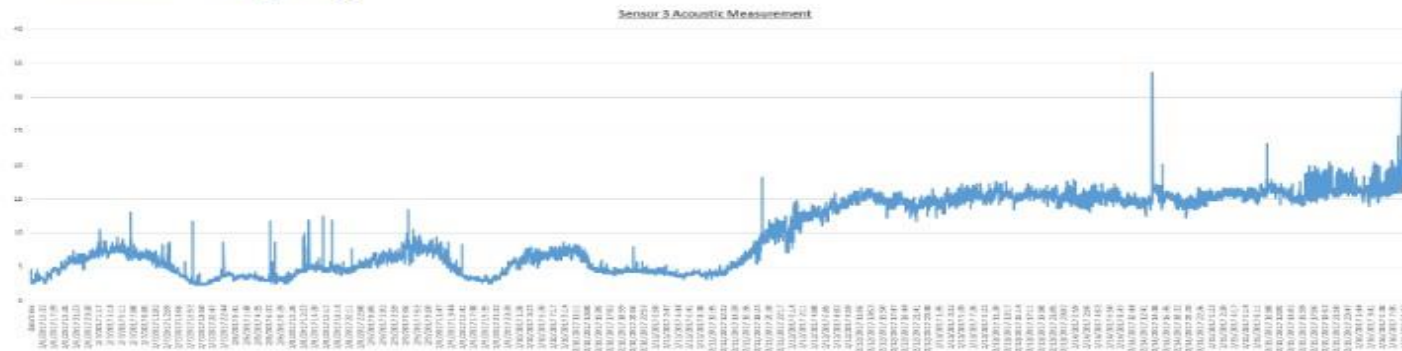
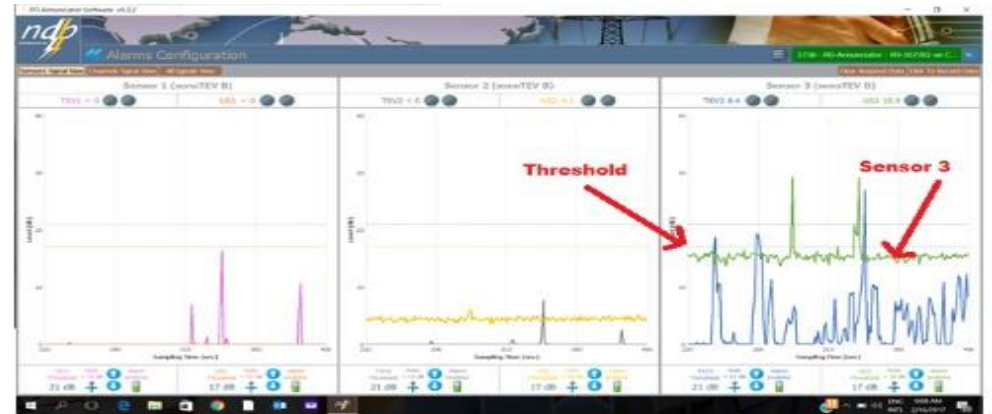
After Maintenance:-

- ✓ Repair and Replace Termination

SEC Substation 2738

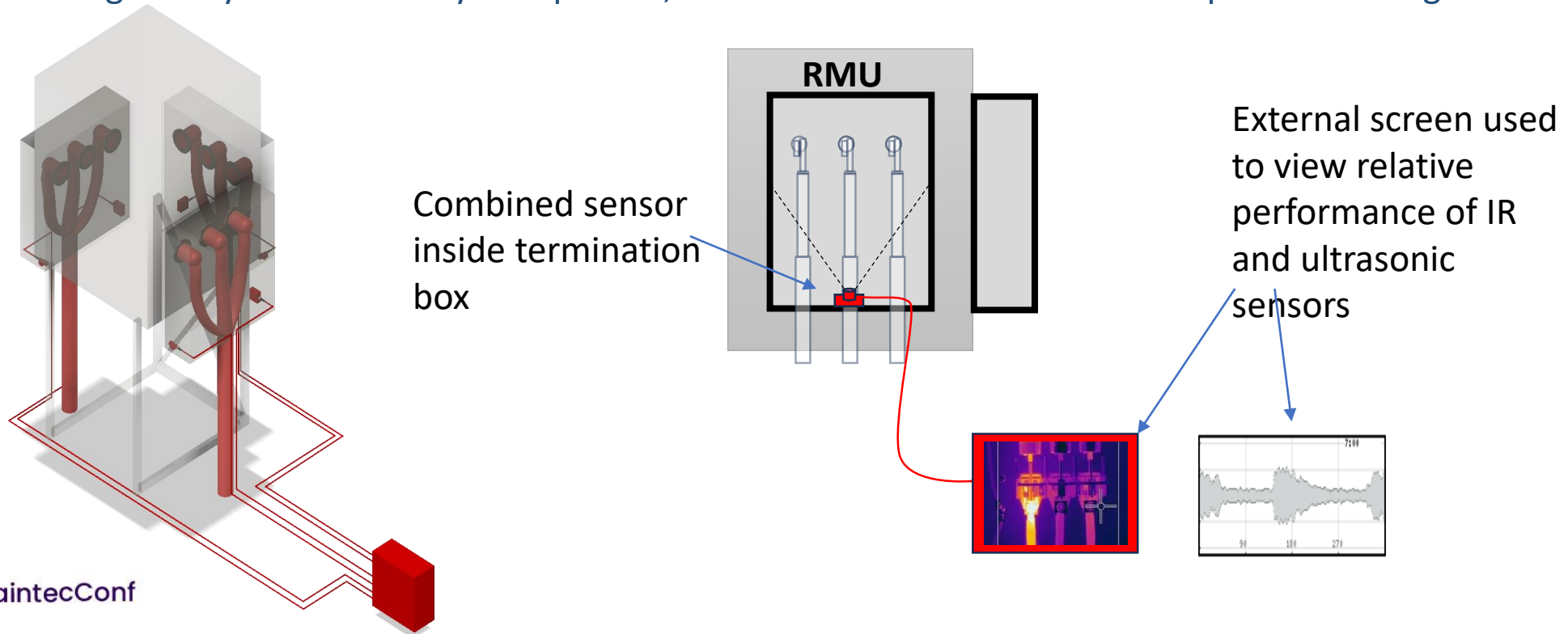
High level of partial discharge on sensor 3

One month data analysis showed PD activity increasing rapidly

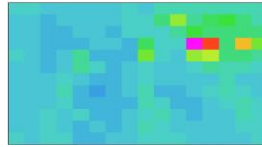
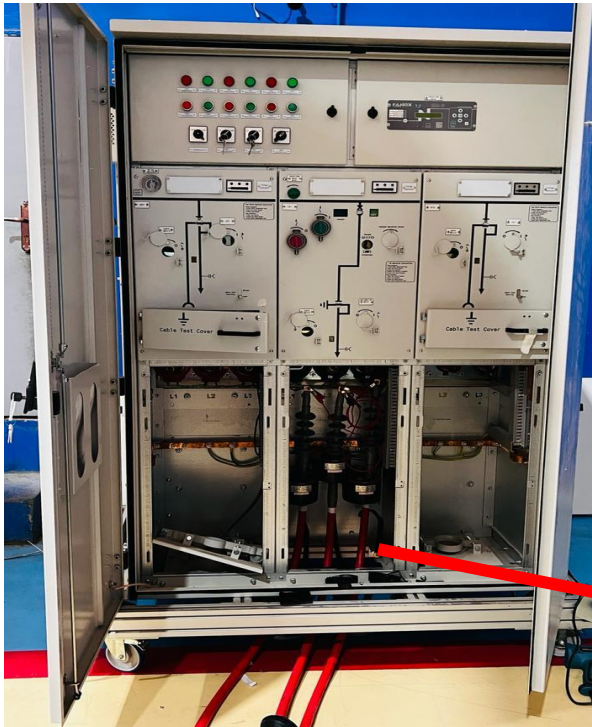


MONTHER system Integrated in Smart RMUs

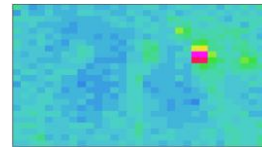
Improve the operational reliability of RMUs - This will be done by alerting maintenance teams to defects in the RMU cable terminations. These defects are known to deteriorate over time and are likely to lead to flashover and cause an HV fault and unplanned outages. By raising alerts it is possible to carry out maintenance in advance of the fault meaning that system reliability is improved, and the cost of a fault and consequential damages are avoided.



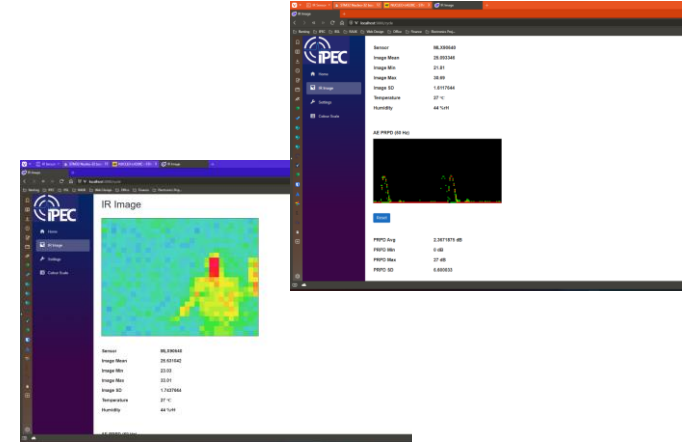
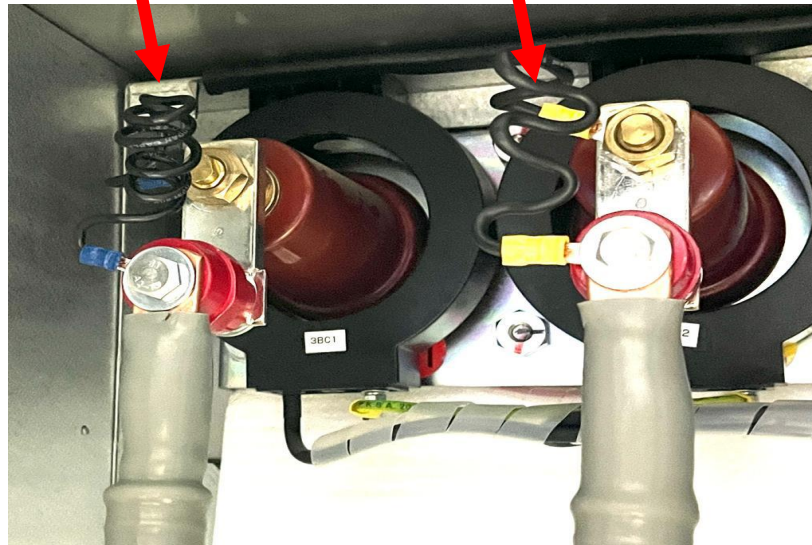
MONTHER Improvements



High resistance connection



Low resistance connection

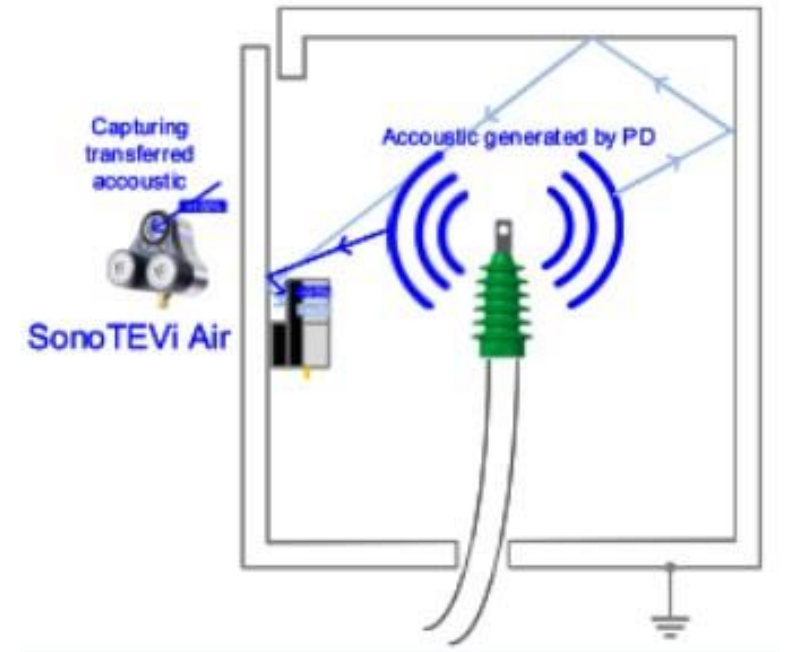


- Connected all 3 phases together in series
- Circulated a current in range of 25-50A
- High resistance connection forms a hotspot

MONTHER Improvements

□ New Sensor :-

- New Sensor for installation inside cable compartment
- Increased Sensitivity
- External High Frequencies Immunity



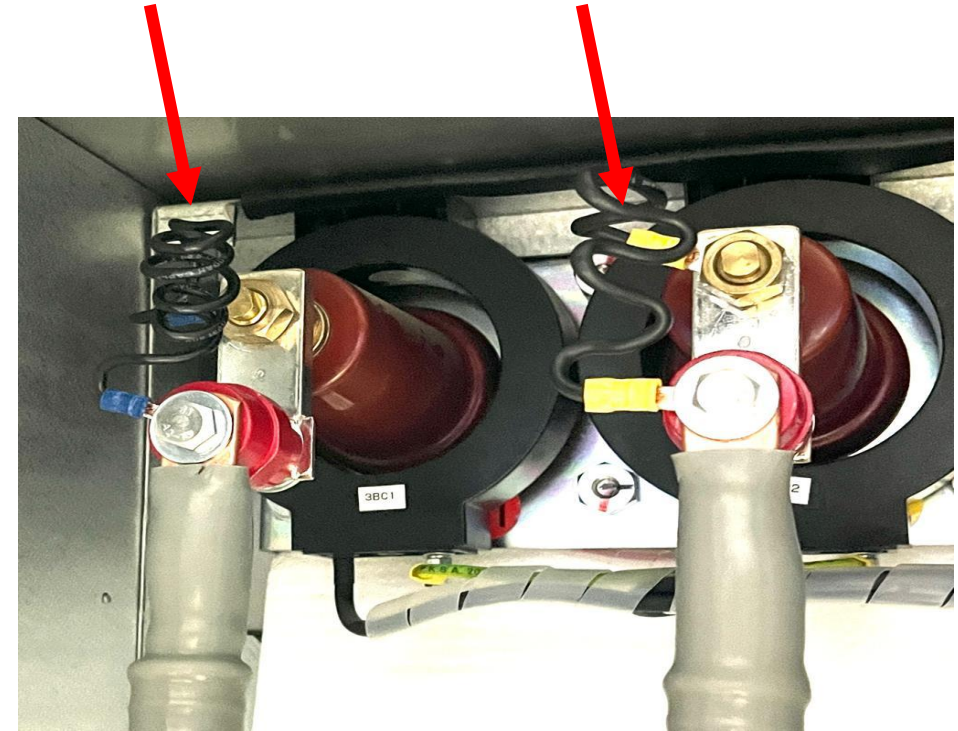


MONTHER Improvements

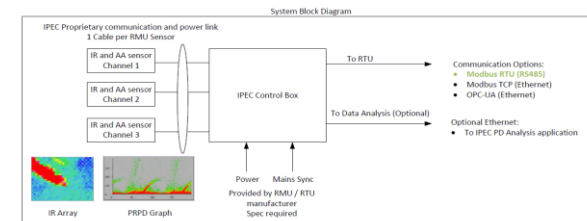
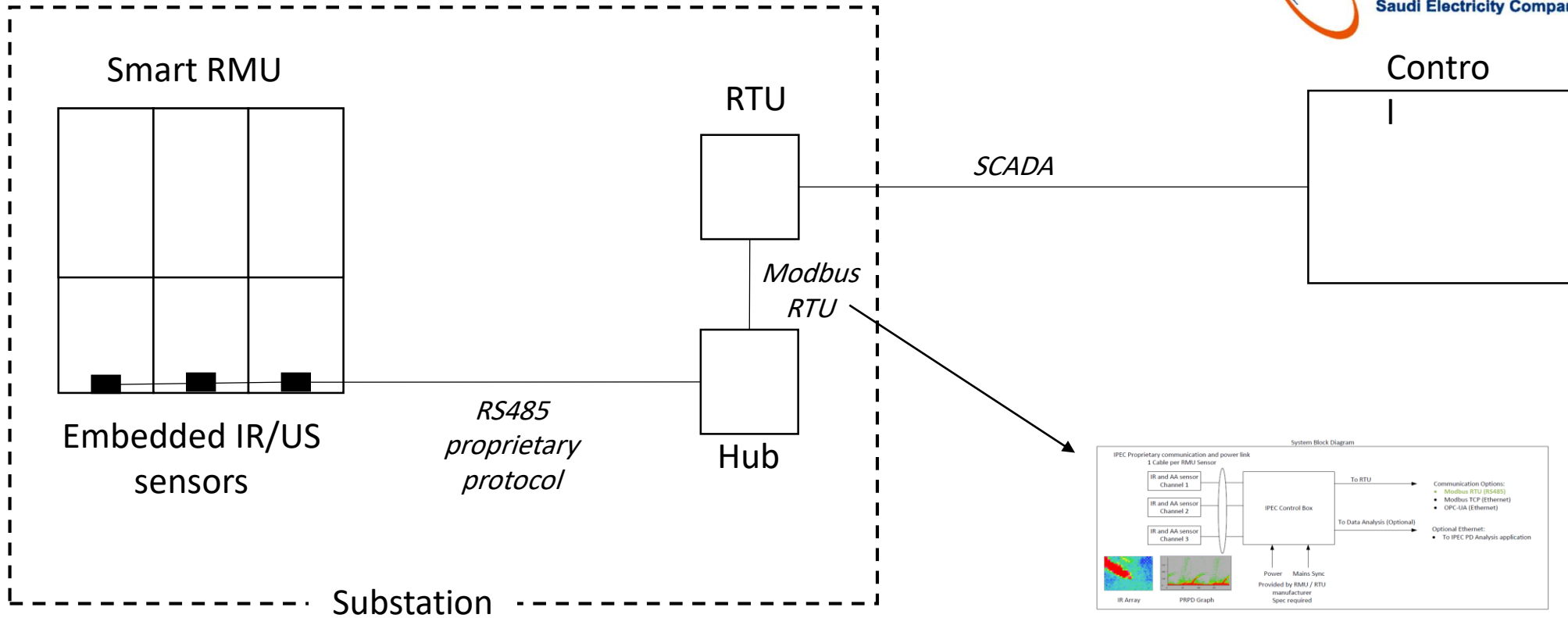


High resistance connection

Low resistance connection



Proposed next step

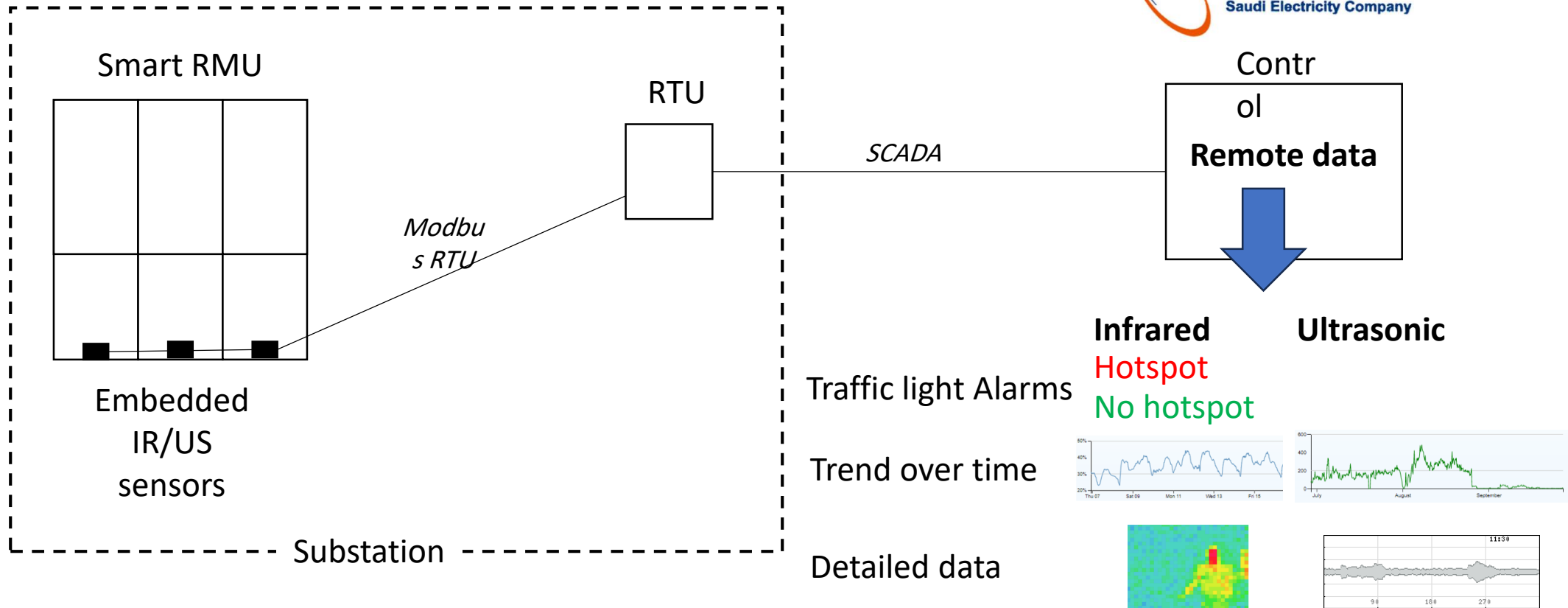


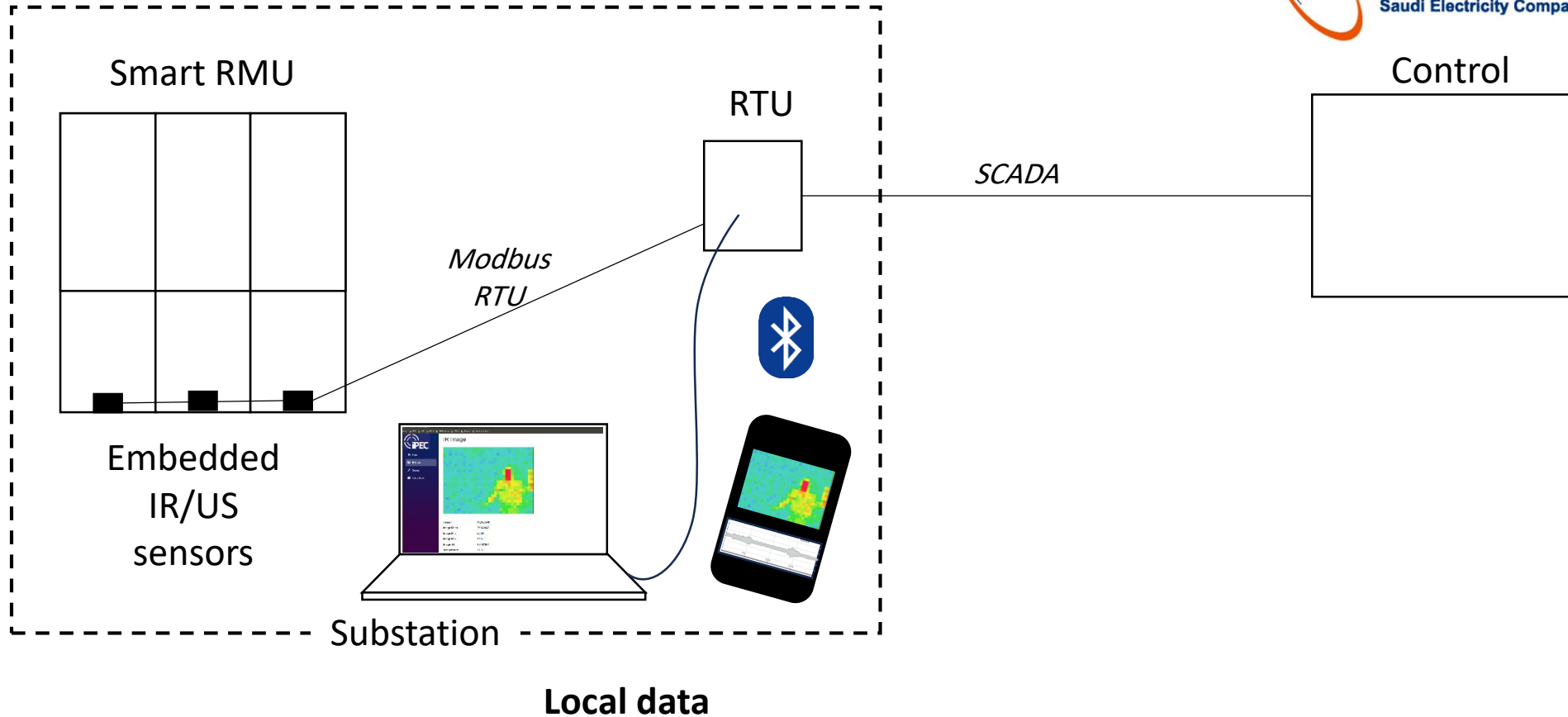
Suggested Modbus Registers

Channel 1 (Channel 2 Channel 3)	Channel 1 (Channel 2 Channel 3)	Description	Data Type	Interpretation	Returned value Example	Processed results Example
300	300	300 Status	UNIT16	0 = Error, 1 = OK	1	OK
301	301	301 Ambient Temperature	UNIT16	Temperature in degrees C (divide by 10)	205	20.5C
302	302	302 Ambient Humidity	UNIT16	Humidity in %RH (divide by 10)	405	50.5%
303	303	303 IR Image Peak	UNIT16	Temperature in degrees C (divide by 10)	1050	105.0C
304	304	304 IR Image Min	UNIT16	Temperature in degrees C (divide by 10)	215	21.5C
305	305	305 IR Image Average	UNIT16	Temperature in degrees C (divide by 10)	385	38.5C
306	306	306 IR hot spot severity	UNIT16	Score between 0-100	80	80
307	307	307 AA peak	UNIT16	AA amplitude in dB (divide by 10)	567	56.7dB
308	308	308 AA average	UNIT16	AA amplitude in dB (divide by 10)	224	22.4dB
309	309	309 AA Severity	UNIT16	Score between 0-100	40	40

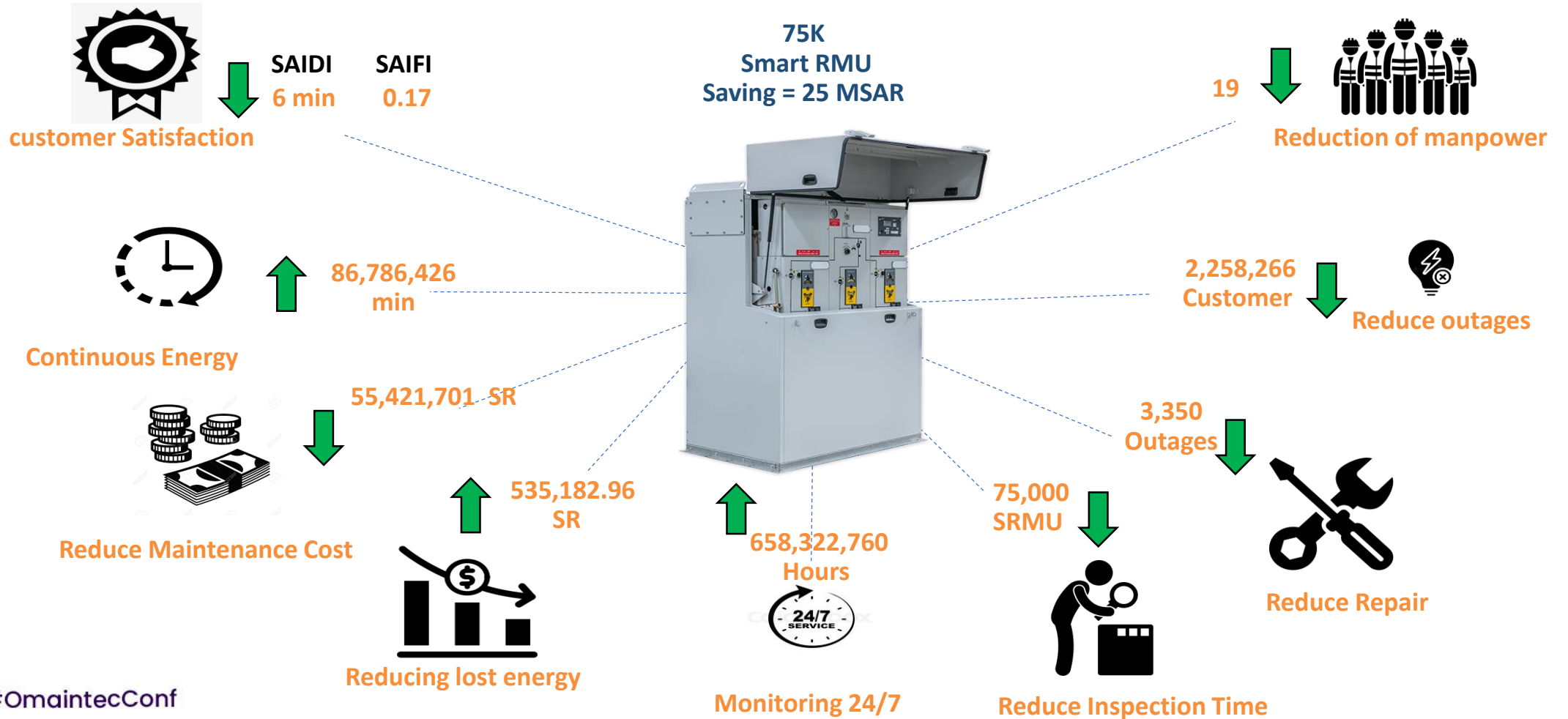
Note: Acoustic PRPD (x = 360 x y = 80) and IR Image (x = 32, y = 24) are arrays of data that are used to construct a bitmap image. This are not included but can be supplied separately.

Data requirement





Pre-feasibility study results





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