PART D: AMI Deployment at Eskom

Speaker:

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Main drivers for AMI in South Africa

Maximise Operational efficiencies - Achieve improved billing accuracy through automated reading,
revenue protection and low voltage (LV) network monitoring, control and visualisation.

Introduce cost reflective tariffs for all customer segments

4IR, Smart Cities, Big Data

(4D's) Decarbonisation, Decentralisation, Digitisation, Democratisation.

Support Demand Management through:

- Load Shifting - Shift load of medium to high (1000kWh/month) residential consumers (LSM 7 and above) through TOU tariff
- Promoting Customer Behaviour Change - Incentivise the efficient use of electricity, power conservation through dynamic tariffs.
- Load Control – Control non-essential appliance load during system constraints / emergencies – About 3500 MW (7000MW nationally)
- Micro-generation – Facilitation of micro-generators billing (Small-scale embedded generation -SSEG)

Background

2010

Pilot project of 10000 meters with 2 Suppliers

Proprietary protocols

2011 – 2014

Refining specification and introducing standard and open protocols

Learning from the pilot

2015 – 2016

± 50 000 meters project in Sandton/Midrand, Lusikisiki and Raymond Mhlaba Municipality

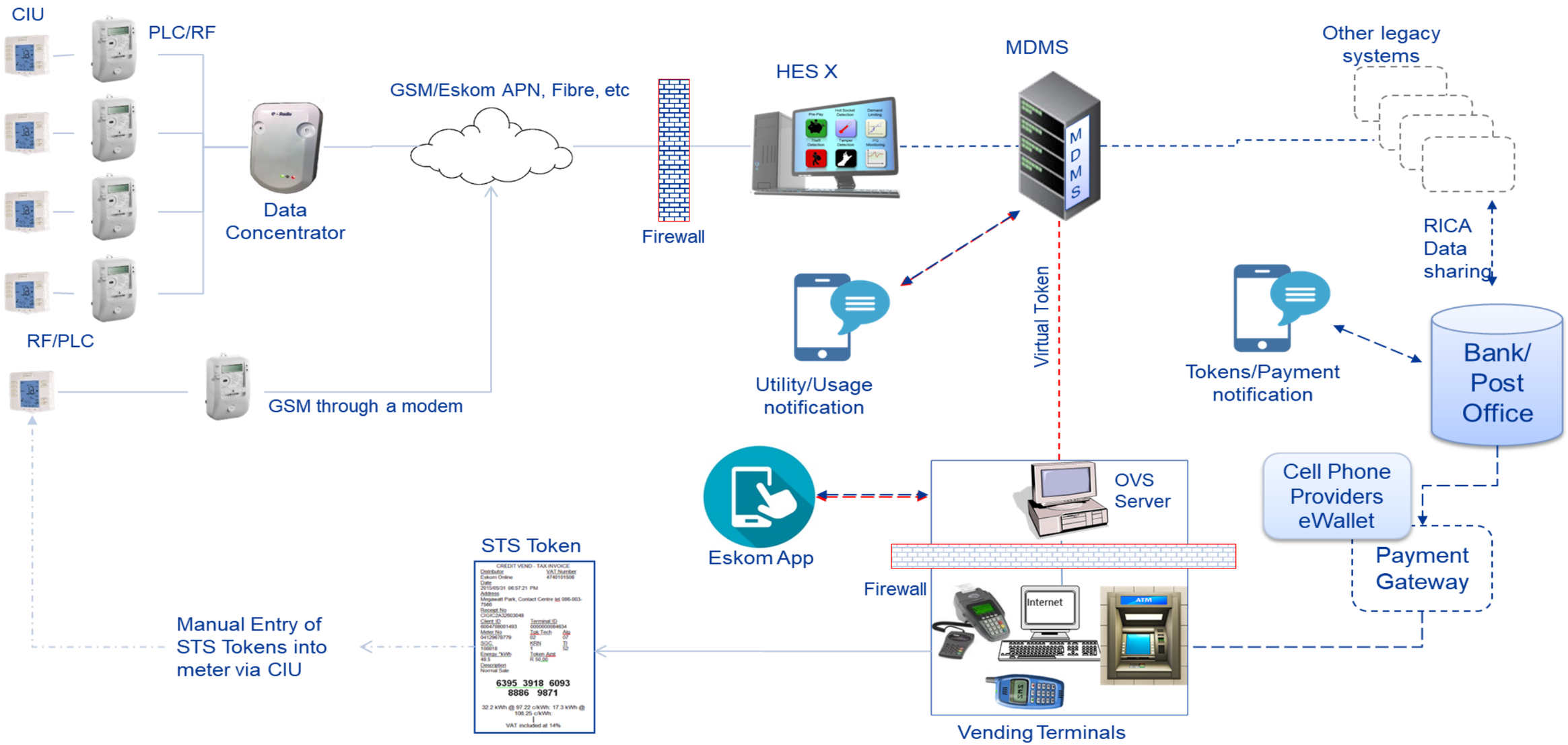
2021 . . .

Decision taken to replace all meters with smart meters

Over 370 000 smart meters installed to date & project ongoing

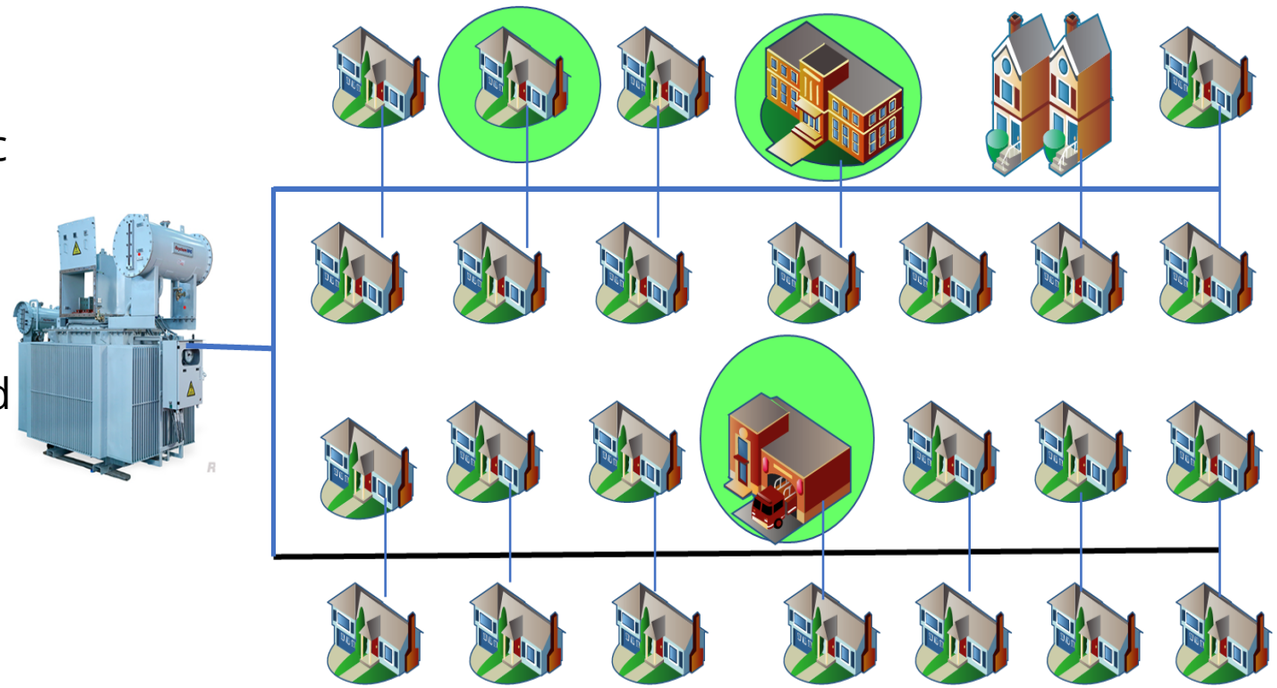
Project could be accelerated subject to funds availability

Systems Architecture



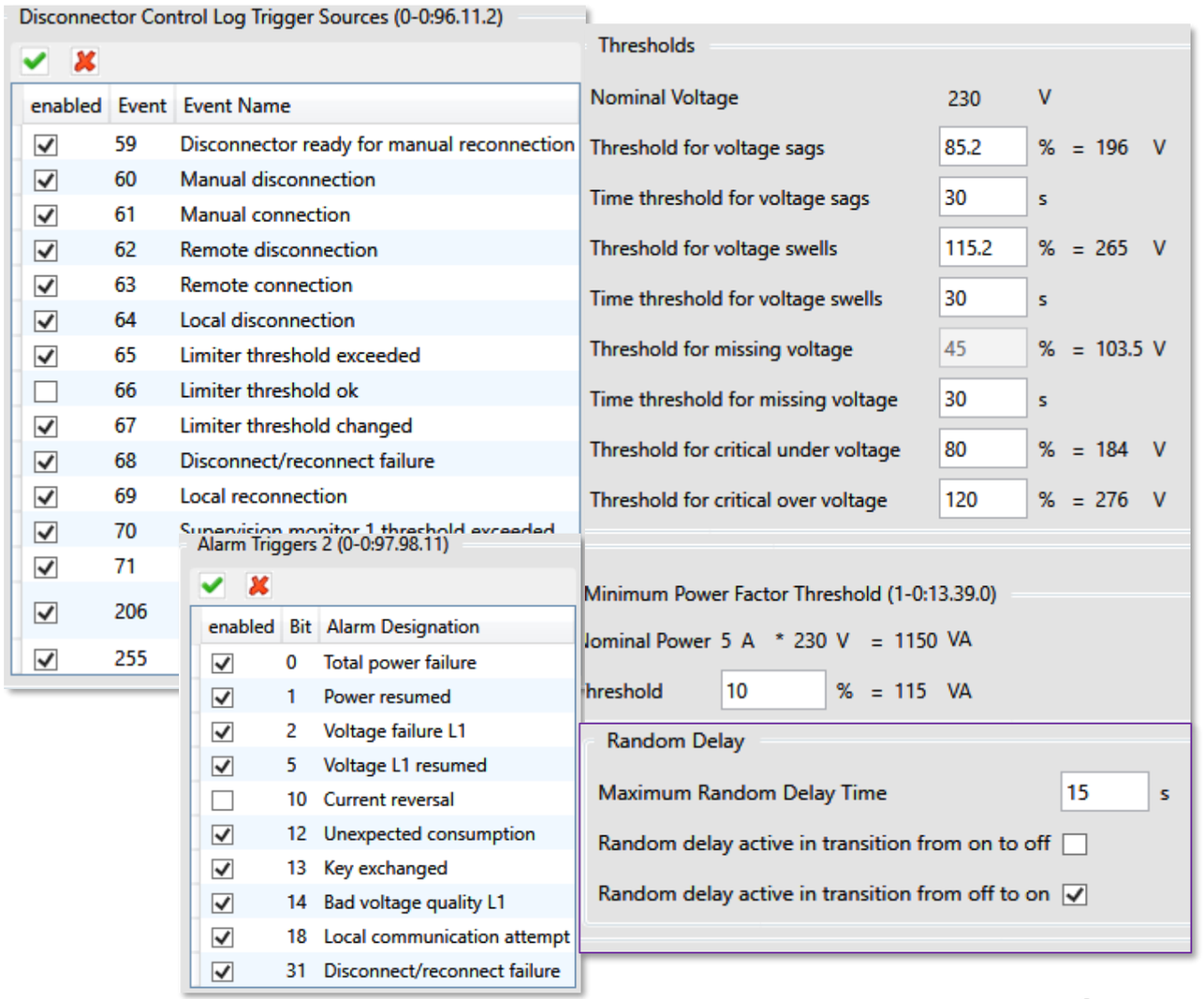
On Demand Control implemented

- Remote connection/disconnection
- Selective disconnections leaving essential loads on e.g. houses with special needs, schools, hospitals, etc
- Limit power output of meter based on NMD
- Temporary take off some load off the network when the system is under constrain
- Selective load reduction in areas with high losses and non-payment – target non-paying customers
- Render meter not useful by setting load limit to zero
- Limit energy exported to network by customer
- Detect missing/stolen and rouge meters
- Remotely covert customers from postpaid to prepaid and visa versa.
- Remote configurations



Auto Controls Implemented

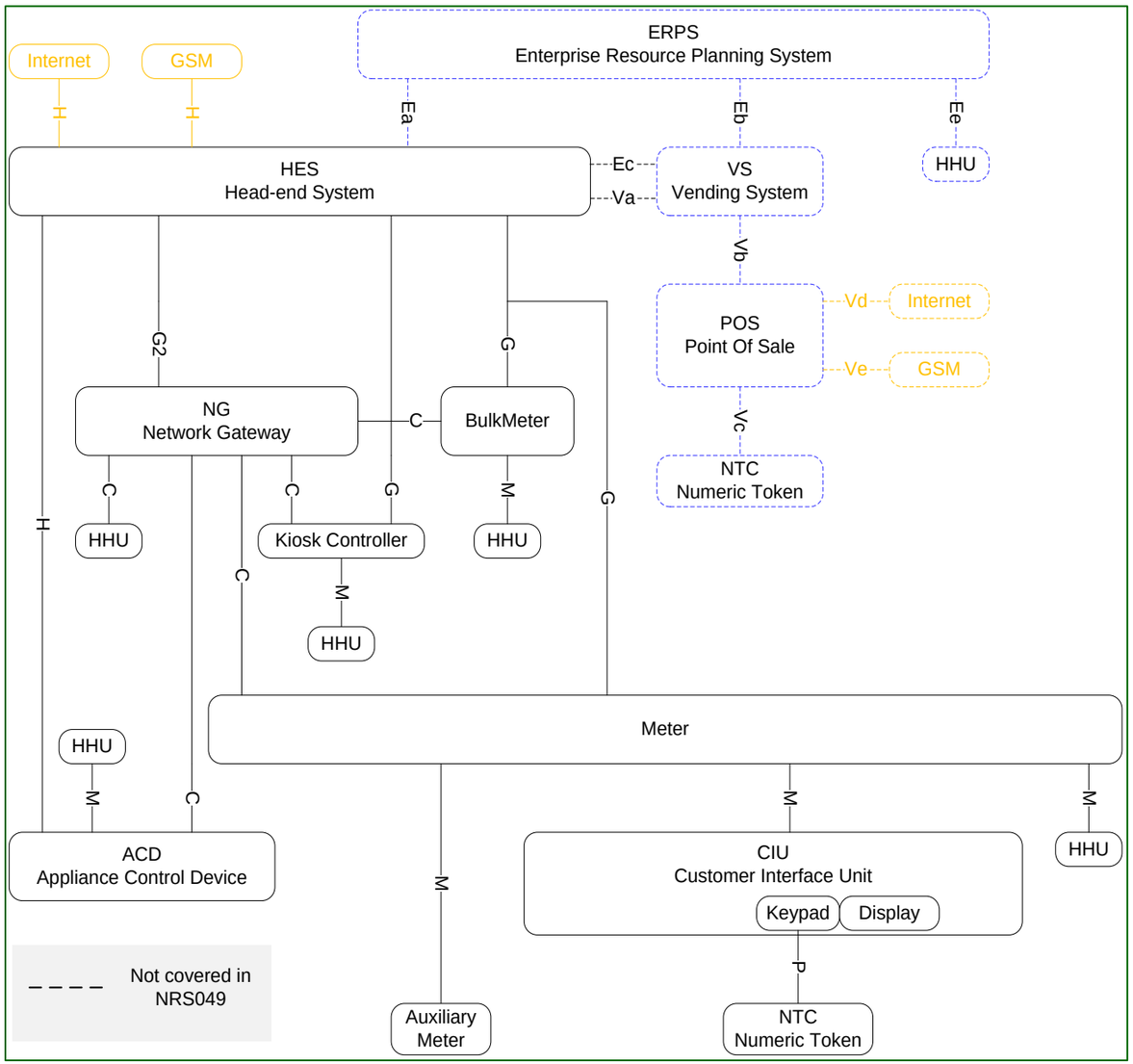
- Automatic disconnection when under/over voltage is detected, meter auto reconnection when voltage is normal
- Automatic disconnection when overload is detected and auto reconnection.
  - E.g. NMD exceeded
- Automatic disconnection when remaining credit is zero when on prepayment mode
- Staggered power come back to eliminate surges.
- Auto disconnect on power failure
  - Customer cannot export energy to network
  - Utility staff safe if working on network



Demand Management Through Pricing Signal & Smart Meters

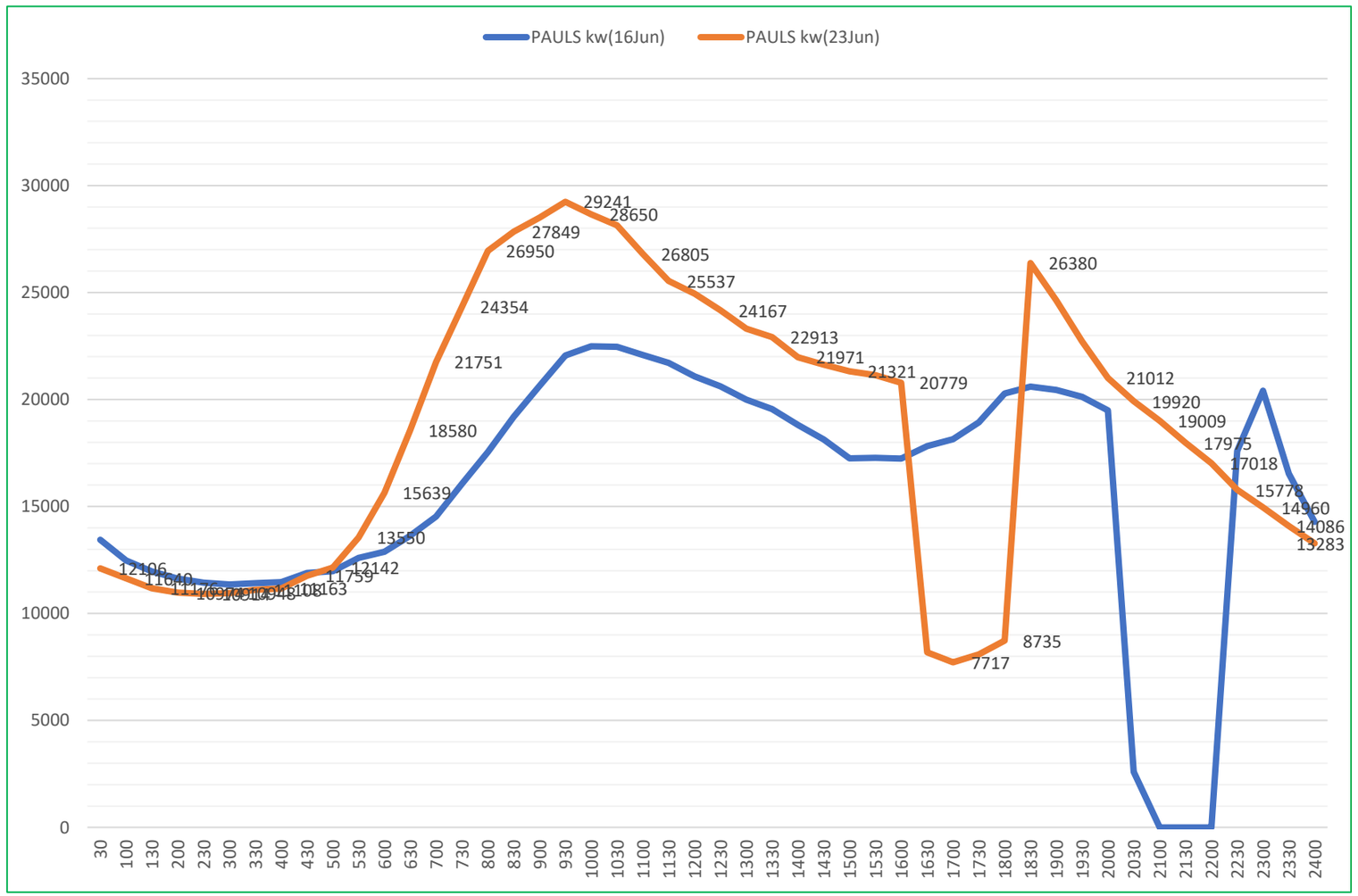
- Implement dynamic and cost reflective tariffs
  - Time of Use (TOU)
  - Critical Peak Pricing (CPP)
  - Etc.
- Buy back excess power from customers during peak periods or when system is constrained – buy back tariff required
- Feed-in tariff - customers reimbursed for energy exported into the network for Rooftop PVs, battery storage, EVs, etc.
- Voluntary load reduction

DSM Through Load Limiting



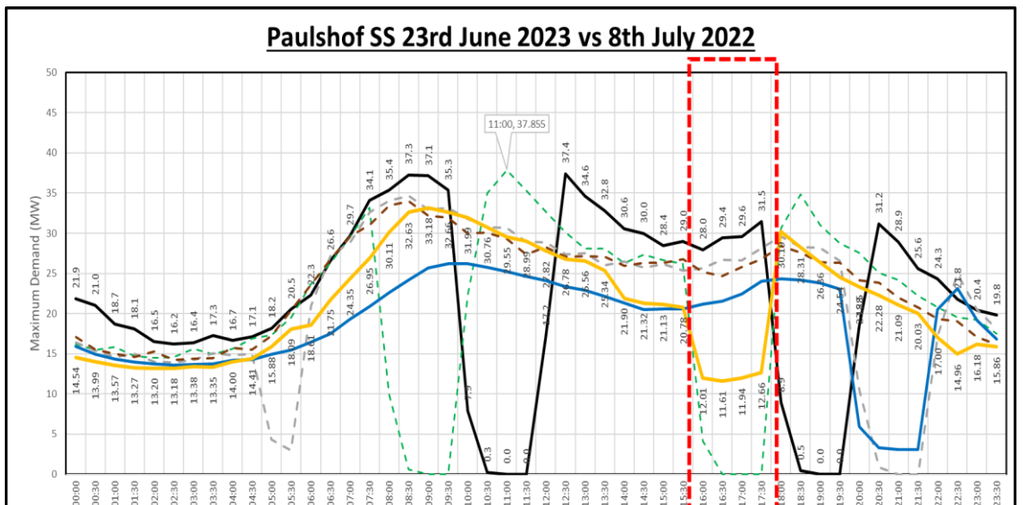
- Load limiting is the deliberate act of limiting the maximum output power of the meter for a pre-defined period for the purpose of controlling demand – e.g., from 80A (18.4 kW - 20A (2.3 kW)
- Load limiting is currently applied as an alternative to load shedding (rotational blackouts)
- Heavy energy consumption appliances such as geysers, pool pumps, under floor heating must be switched off
- Lights and electronics appliances such as TV, laptops, Wi-Fi routers can be used – customer is not in complete darkness
- If set power limit is exceeded, meter disconnects supply & locks out for a period
- Activation: Load limiting schedule/command is sent to the meter and is set to expire at end of a pre-determined period.
- The meter automatically resets back to its original state at the end of the defined period.
- Current approach is also for utilities not to own ACDs to avoid maintenance and issuing of COCs. The ACDs are therefore owned by customers.

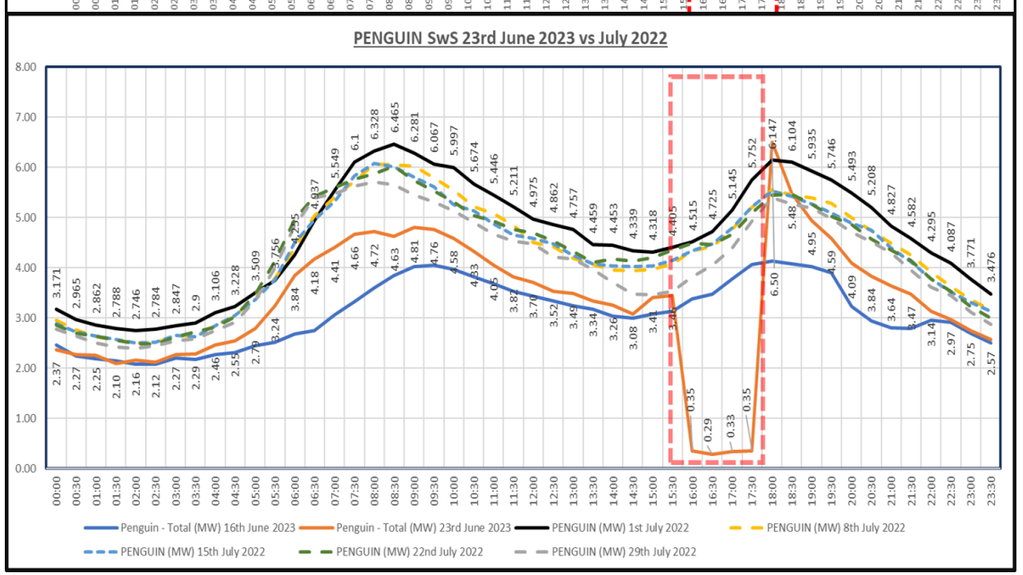
Load limiting Pilot Project results



- Meter data from Paulshof substation
- The blue graph is the actual load consumed on the 16 June 2023. The station was subjected to loadshedding from 20h00 till 22h00
- The orange graph depicts customer load on 23 June 2023.
- Load limiting was implemented from 16h00 till 18h00. The load at the sub dropped from 20 779 kw to 7 717 kw. Resulting in a reduction of 13 062 kw or (62.86% reduction)

Load limiting Pilot Project results



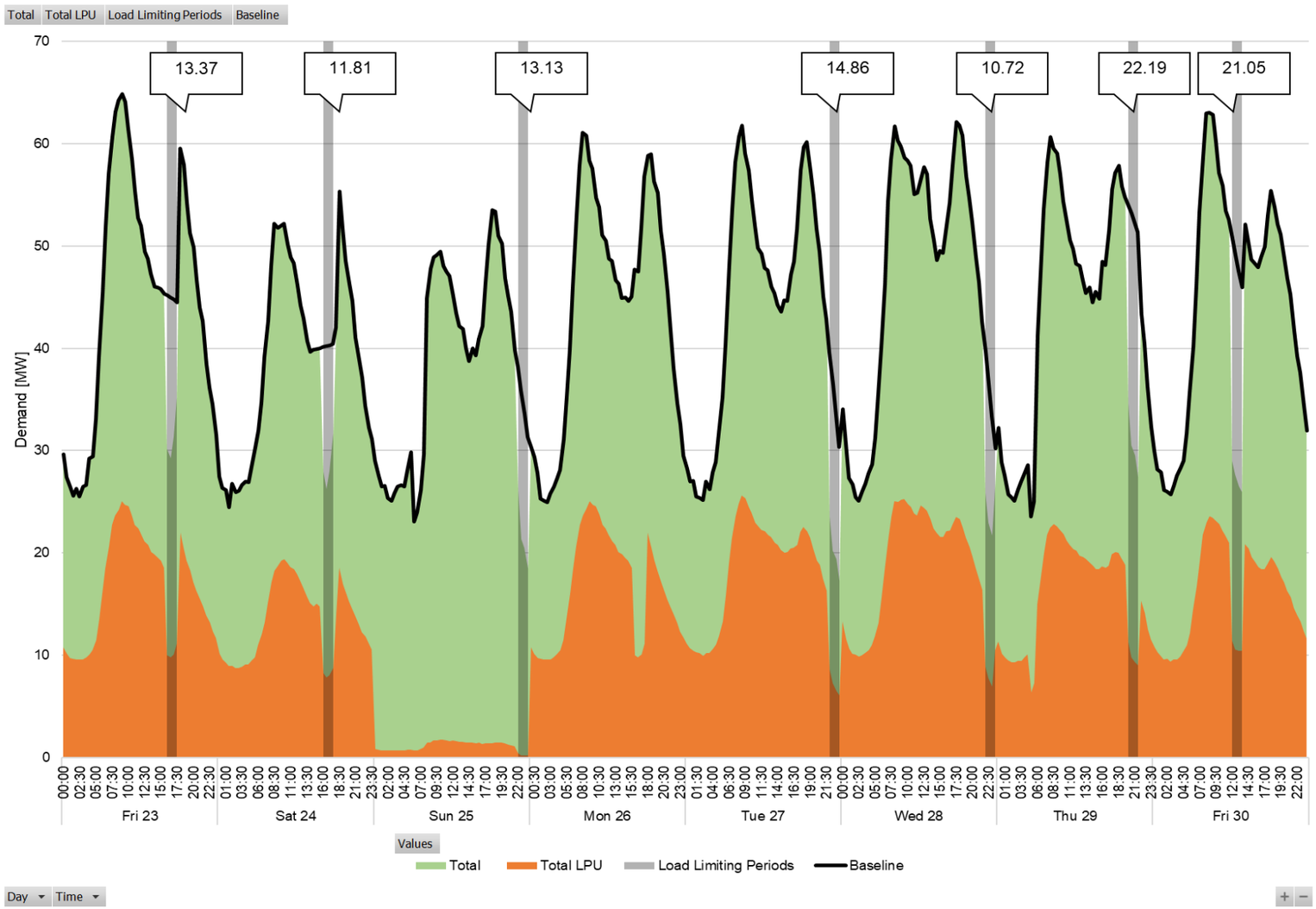


Paulshof Substation.

- A ~**45% drop in demand** (approximately 10MW) was observed.
- Reduction would have been more if we had the ability to load limit the LPU points as well.
- A shift in peak was noted during the period immediately after load limiting at 30 MW compared to the July 2022 evening peak of 31.5 MW.

Penguin Switching Station.

- A ~**92% drop in demand** (approximately 3MW) was observed.
- There was a significant reduction in the demand compared to the July 2022 peaks.
- A shift in peak was noted during the integration period immediately after load limiting at 6.5 MW compared to the July 2022 evening peak of 6.147 MW.



- There was a significant reduction from the day of inception as the system communication improved, more meters were reached hence there was a high coverage and MW reductions are realized and improved.
- There is an average demand reduction of 15.3MW during the load limiting periods.
- The demand reduction is highly dependent on the time of use (Peak; Standard or Off-Peak)
- Options for LPUs to participate in project are being explored
- The number of meters receiving the load limiting command was 5162
- A further 1874 premises require meters changes as they are currently using non-Smart Meters

Load limiting on microgrids using smart meters

- Primary aim is to load limit meter to preserve storage, multi level load limits may be implemented
- DLMS/Cosem and IDIS 2 for smart meters and ACDs
- ACDs and SM are linked at HES level
- Customers should be able to buy their own ACDs from retailers
- ACDs are to assist customers to dynamically take out heavy loads when meter is load limited.
- Meter will trip 4 times and lockout for 2 hours on the fifth trip if usage is above the limit.
- After 2 hours the meter will get out of the lock mode and the process will repeat itself
- If ACDs are present, load will be dynamically reduced
- When ACDs disconnect loads and meter lockout will be avoided

Key take aways

When rolling out smart meters:

- Develop enabling KPIs, ensure the project is sufficiently resourced.
- Ensure sufficient front-end planning, solution design, process design, impact assessments is undertaken with respect to all streams. Purchasing meters is last.
- Perform comprehensive solution (end to end) testing
- Undertake pre-installation audits, identify field issues, billing data versus field data discrepancies, provide accurate installations schedules to installers.
- Automate and integrate the field installation data capture, commissioning, asset / billing system update, installer and supplier payment process.
- Ensure that the current business processes are properly understood – clearly document the impact of AMI on these processes (especially resource impacts
- Customer centric approach is required
  - Utilise different channels to engage customers
  - Incentivise customers to participate (if possible).
- Plan for operations from project initiation.

Thank You

Any questions?

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