Low Voltage Smart Grid System Enables Near Real Time Energy Balancing as a Tool for Detecting and Managing Energy Losses

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Overview

- Utility Challenges
- Brief Description of the Low Voltage Smart System (LVSS)
- LVSS Utility Solutions- Focusing Specifically on Energy Balancing and Revenue Protection
- Requirements for an Effective Energy Balancing System
- Energy Balancing for Revenue Protection and social engineering
- Conclusion

What is driving the evolution to the smart grid?

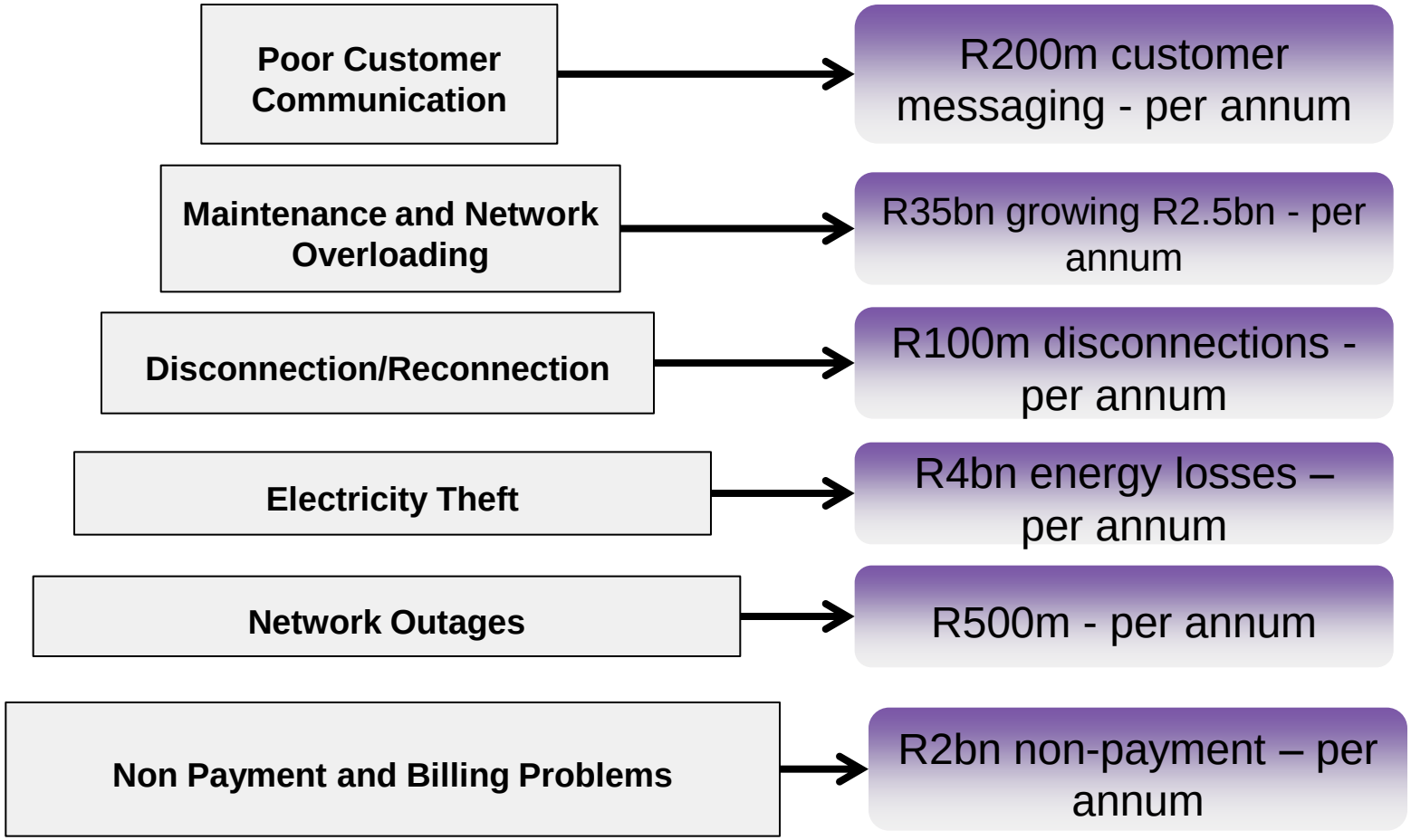
The old problem of supply and demand in balance in real time made more complex by:

- The influence distributed and renewable generation and storage
- The influence of more aware and connected clients
- Economic influence of the cost of supply and wide area grid management

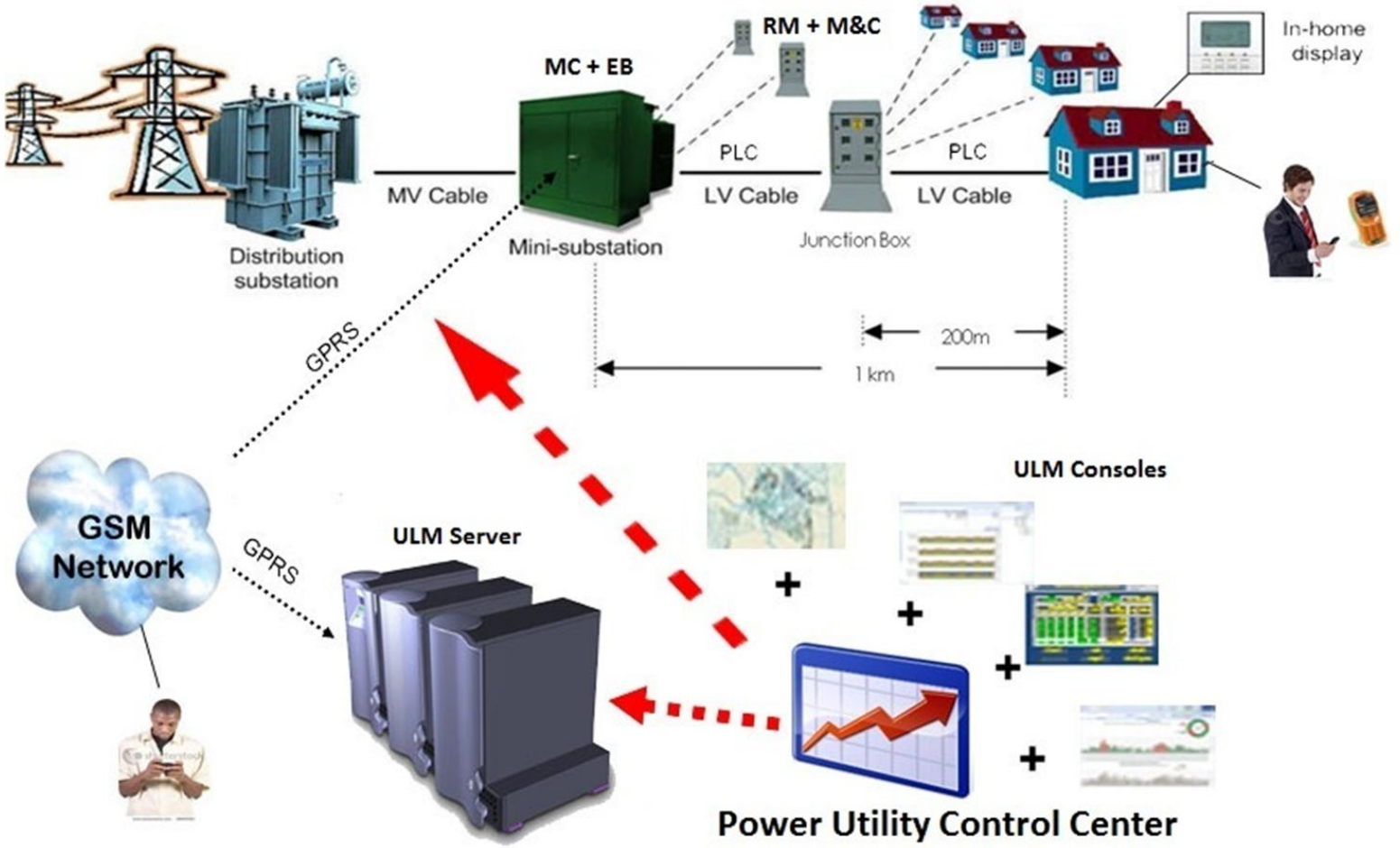
Why get involved

- Enel - Large percentage of Italian homes covered, 4 year payback period and happy customers paying less
- Enel – Isneria project and GRID4EU for distributed generation control

Power Utility Challenges



LVSS


RM + M&C
MC + EB
In-home display
MV Cable
PLC
LV Cable
PLC
LV Cable
Distribution substation
Mini-substation
Junction Box
200m
1 km
GPRS
GSM Network
GPRS
ULM Server
ULM Consoles
Power Utility Control Center

LVSS Utility Solutions- focusing specifically on Energy Balancing and Revenue Protection

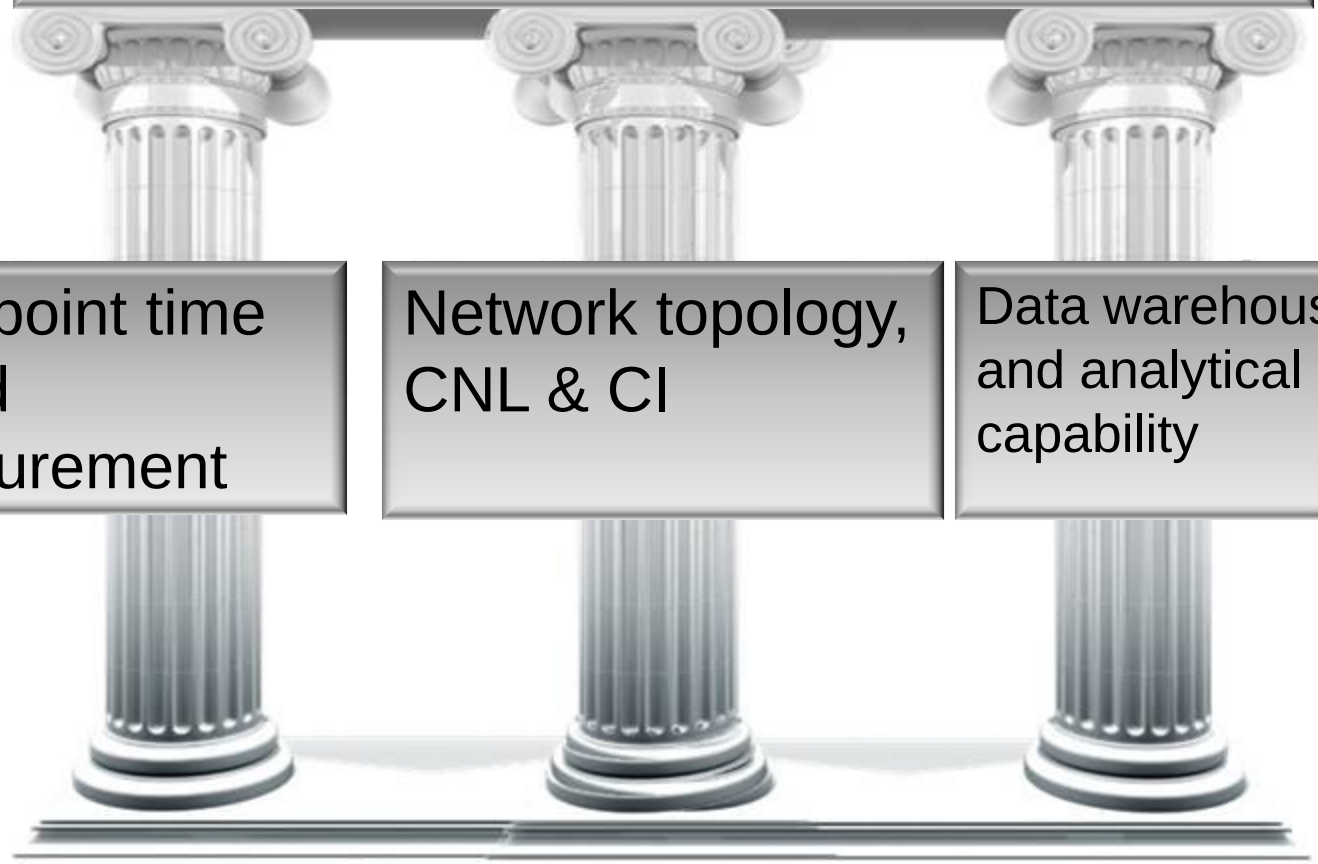
- Energy management
  - Active auditing
  - Remote connect and disconnect
  - Revenue protection works management
  - Social engineering evaluation tool

- Business efficiency
  - Reduce energy losses
  - Improve credit management and billing
  - Improved meter reading
  - Direct communication with customer

Energy Balancing & Revenue Protection

- Balancing the energy Supplied vs. Consumed – a simple idea
- Energy Loss Detection: Ability to track bypassing and to have the advantage of speed to reduce financial impact
- Revenue Loss Detection: Ability to see if energy sold through meters below an energy balancing node ties with the energy flowing through the point

Effective Energy Balancing
-The 3 Pillars



Multi point time based measurement

Network topology, CNL & CI

Data warehousing and analytical capability

Pillar 1: Time based measurements

- The meter and the metering system must be capable of reasonably fine grained energy profile measurement
- Measurement accuracy must be of class 1 or class 2
- Real Time Clocks (RTC) are required on the measurement units, with methods of synchronizing the system time to a reasonable accuracy
- Meters that can detect either relative or preferably absolute phase that they are connected to are a distinct advantage

Pillar 2:
Network Topology

- The meter configuration must be held locally and communicated and kept centrally
- Any change to the configuration that effects EB must be automatically updated and communicated to the central data store
- It is important to gather as much geographic and electric information as practical at roll out

Pillar 3:

Data warehousing and analytics

- Readings need to be stored in a space-efficient manner and indexed for efficient querying
- The configuration snapshot information must be stored efficiently
- The results must be stored within reasonable space requirements and one must be able to query by node and query by time
- Auditing must be easy

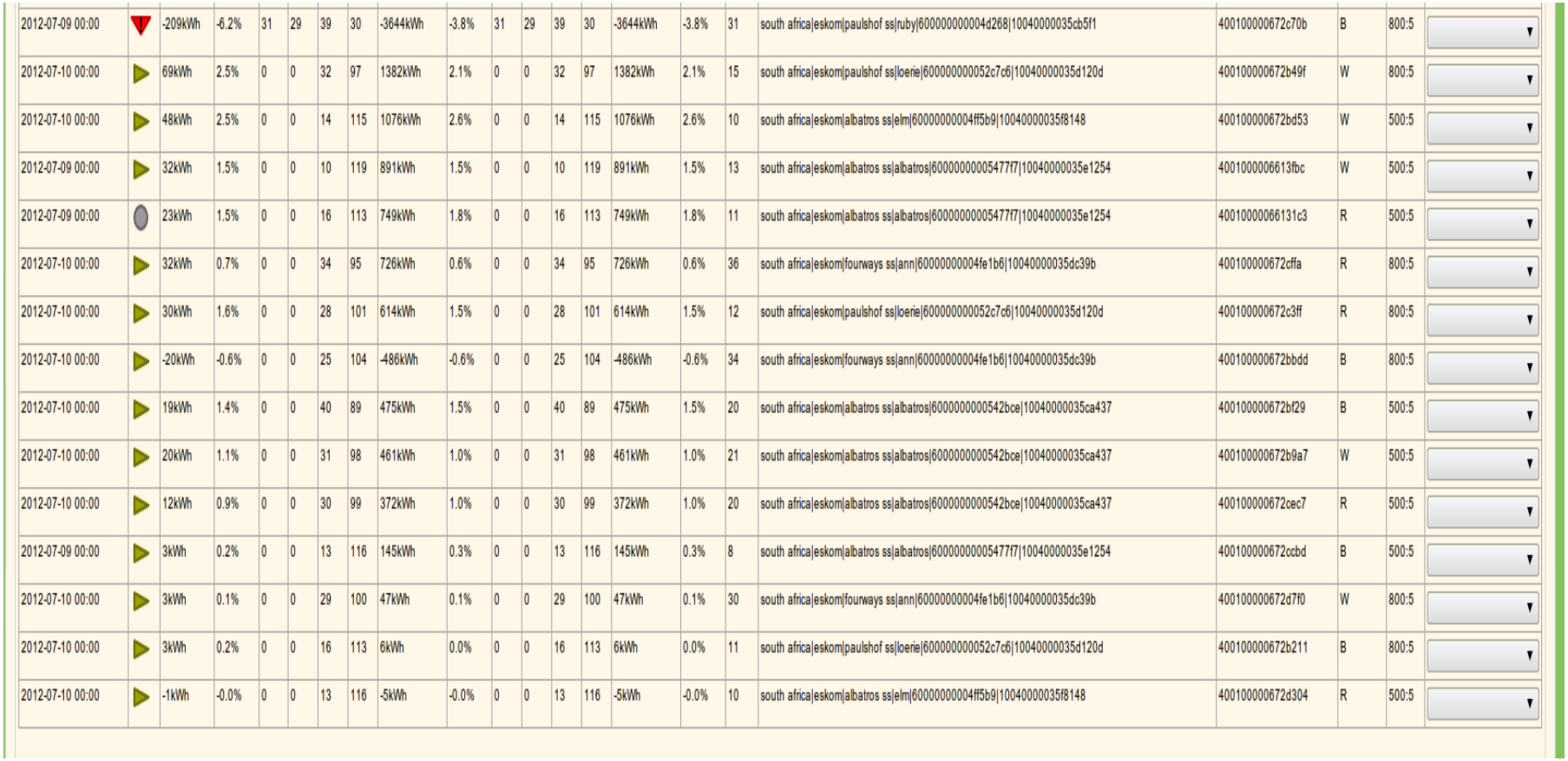
Energy Balancer (EB) in the Roll of Revenue Protection Works Management

- Fully automated daily EB and automated report generation
- Quick assessment on the impact of any field work
- The size of the loss can now be used to focus on areas that will bring the most economic advantage
- Geographic information allows easier planning, better use of resources and avoiding duplication
- The capability to store and analyse large amounts of data enables comparative energy studies

EB in social engineering

- The assessment of social engineering campaigns
- Measuring the efficiency of campaigns according to the type of users
- Allowing tailored messages to be created by the social engineering team
- The effectiveness of a campaign can now be establish with reasonable certainty, possibly changing attitudes towards the social engineering aspect of revenue protection

Energy Balancing Console



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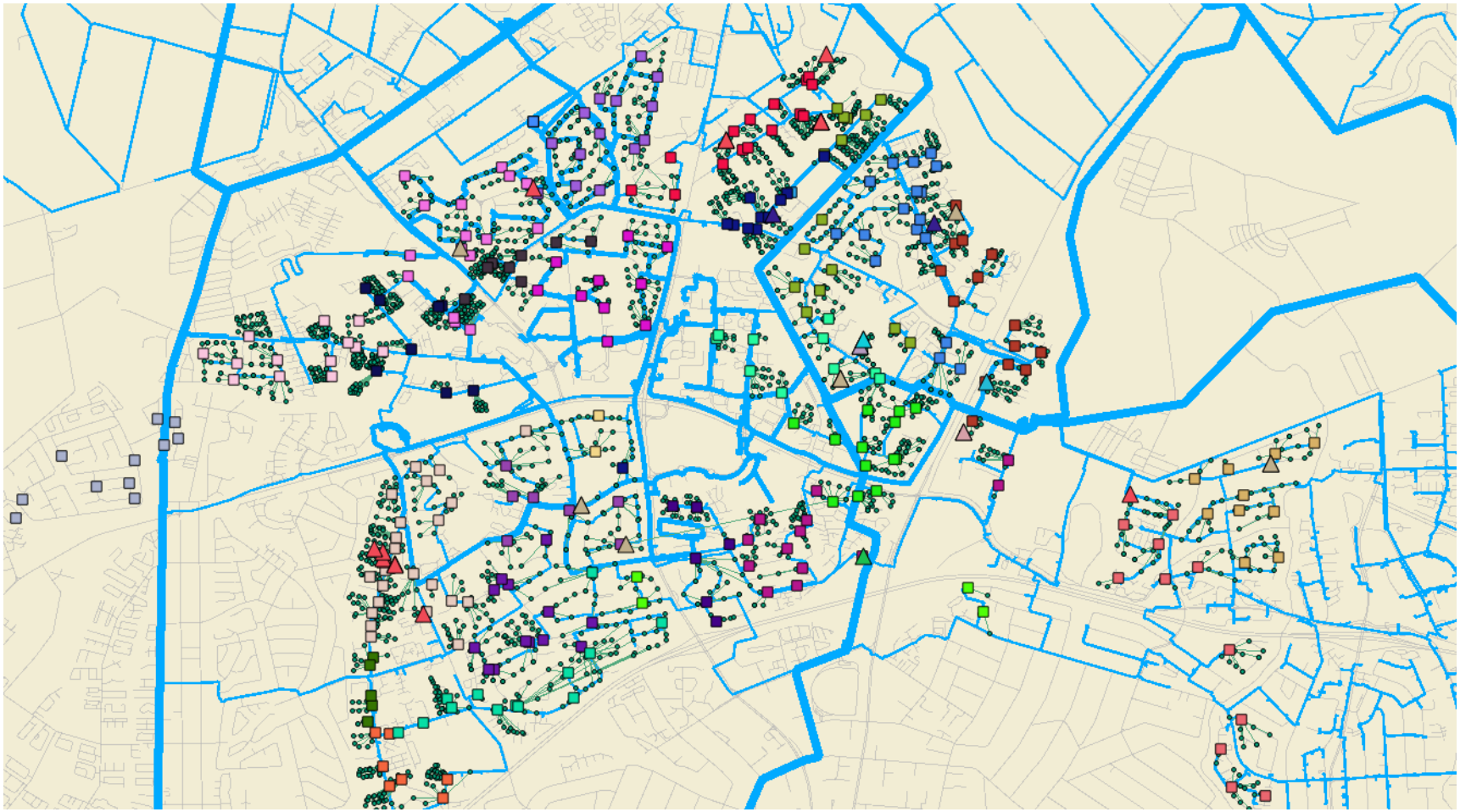
GIS map with system alarms



Conclusion

- LVSS has proven to be stable whether an energy flow is in balance or out of balance
- The system has potential to be a tool for revenue protection and should be installed in areas where energy theft is suspected.

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