Active Network Management

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HYLTON BENNETT-SMARTER GRID SOLUTIONS

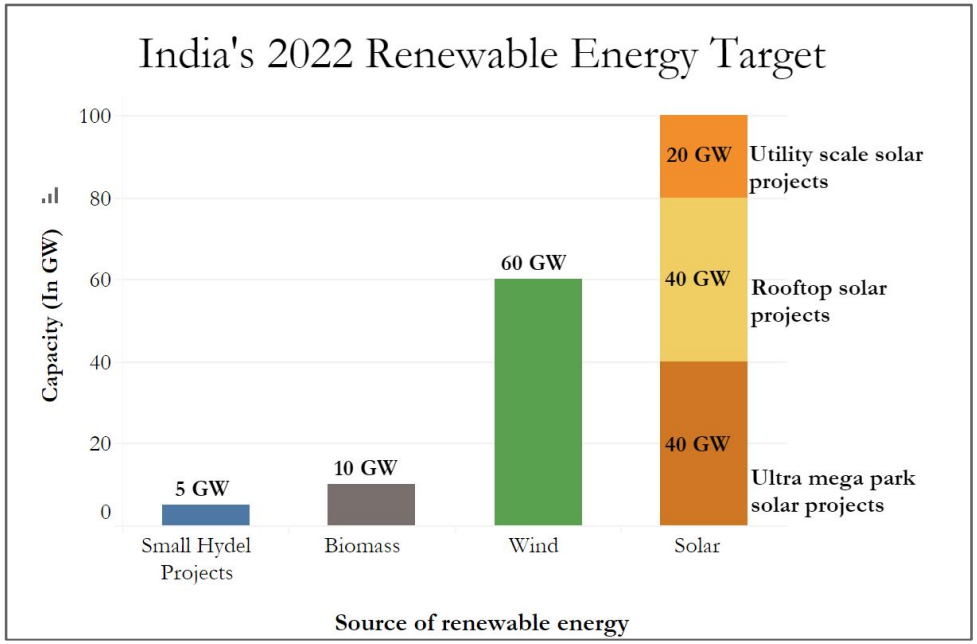
India – Emerging Trends and Challenges

Emerging Trends

- 175GW of renewables by 2022
- Significant electric vehicles by 2030
- Low Wind, Solar energy prices

Challenges

- Maintaining Grid Stability with intermittent gen
- Generation Scheduling due to forecast errors
- High ramping requirements of thermal plants
- Curbing Renewable Energy Curtailments
- Reducing Technical Losses
- Huge Infrastructure upgrade costs



Attributes Needed to Address These Challenges?

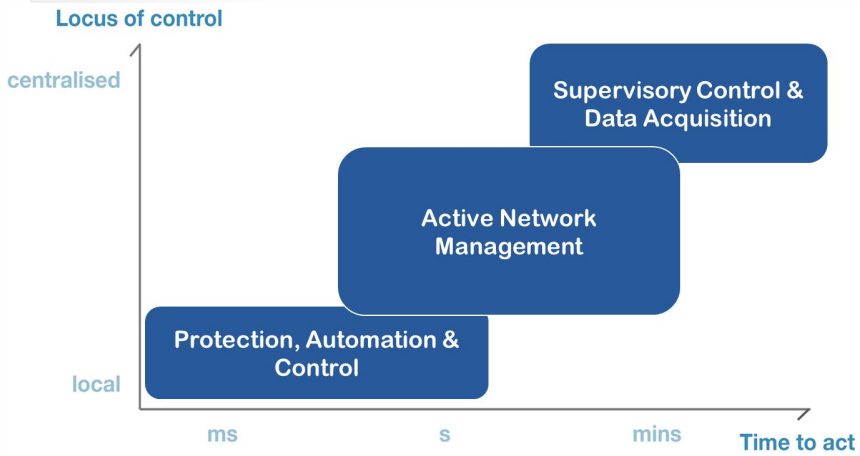
Quick	Time-bounded	Predictable
Repeatable	Fail safe	Easy to integrate
Automated	Secure	Flexible

Active Network Management (ANM)

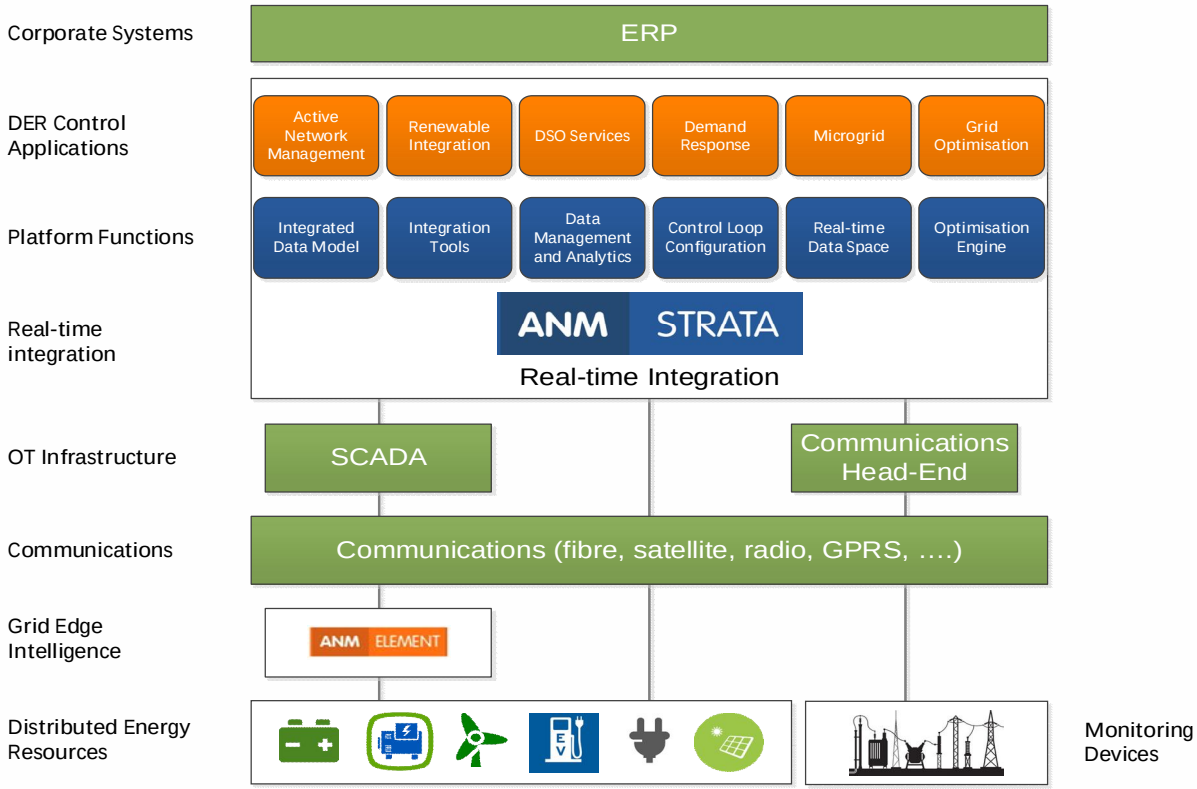
- Platform to perform Real-time, Coordinated, Intelligent control of RE, DERs and other network assets
- Actively manages network devices within their safe operational limits, ensuring overall grid stability.

Active Network Management ensures the overall grid balance in a reliable and efficient way

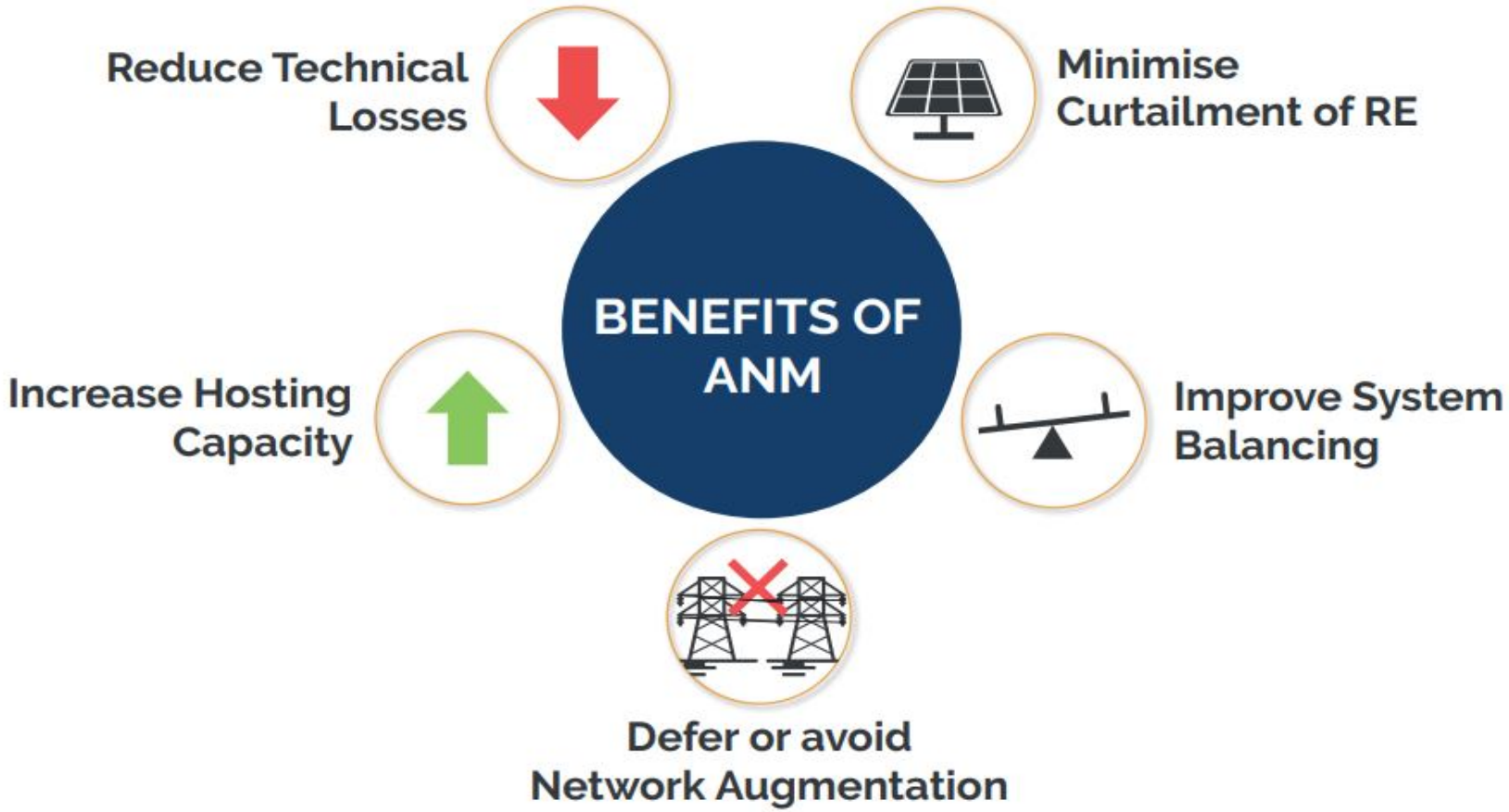
High Level Architecture and Features



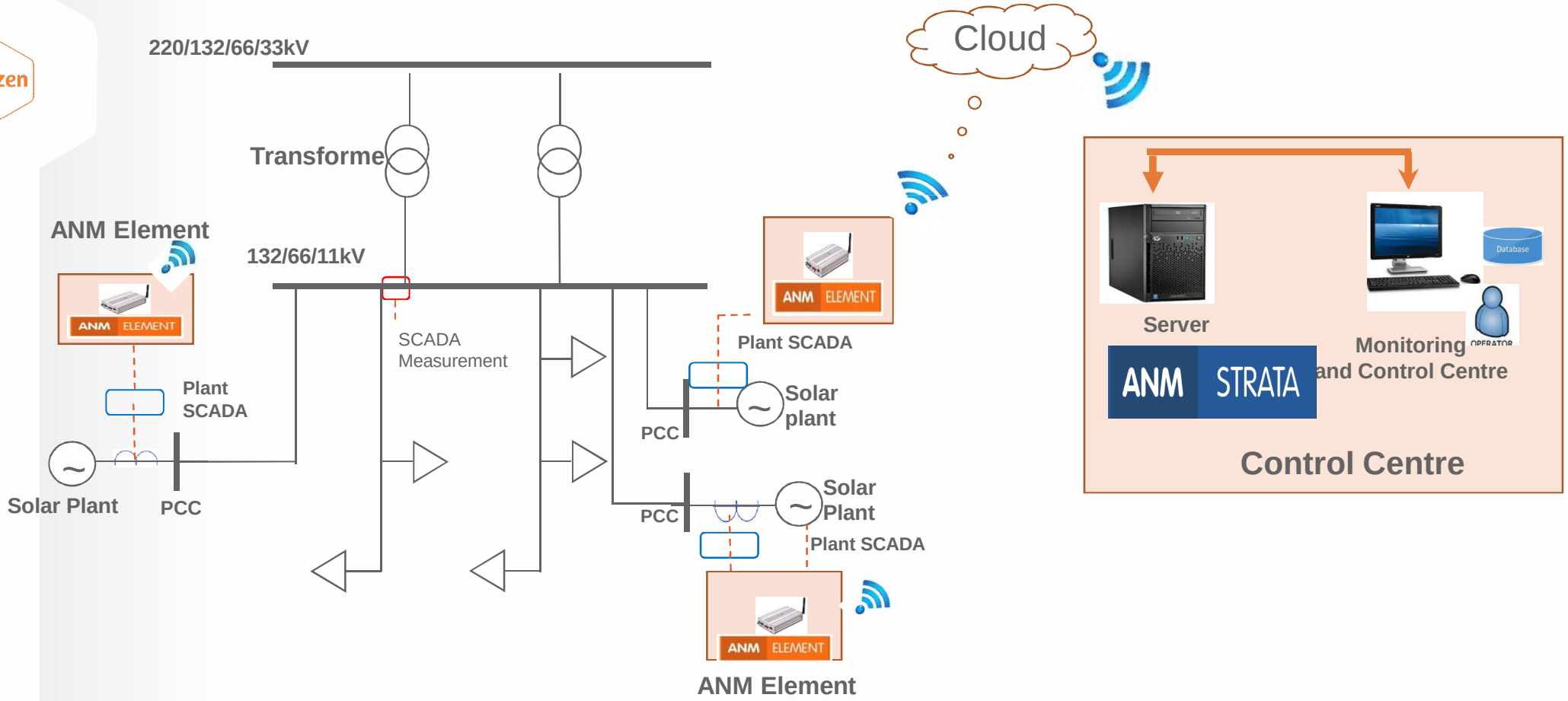
Works along with existing SCADA, EMS and DMS systems



Benefits of Active Network Management



ANM Implementation Architecture



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ANM Strata : Main Overview

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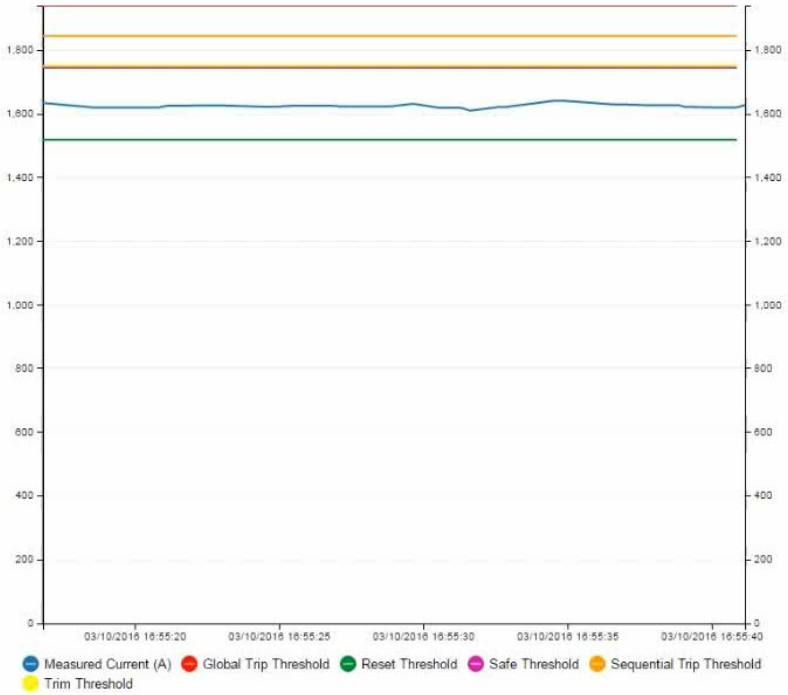
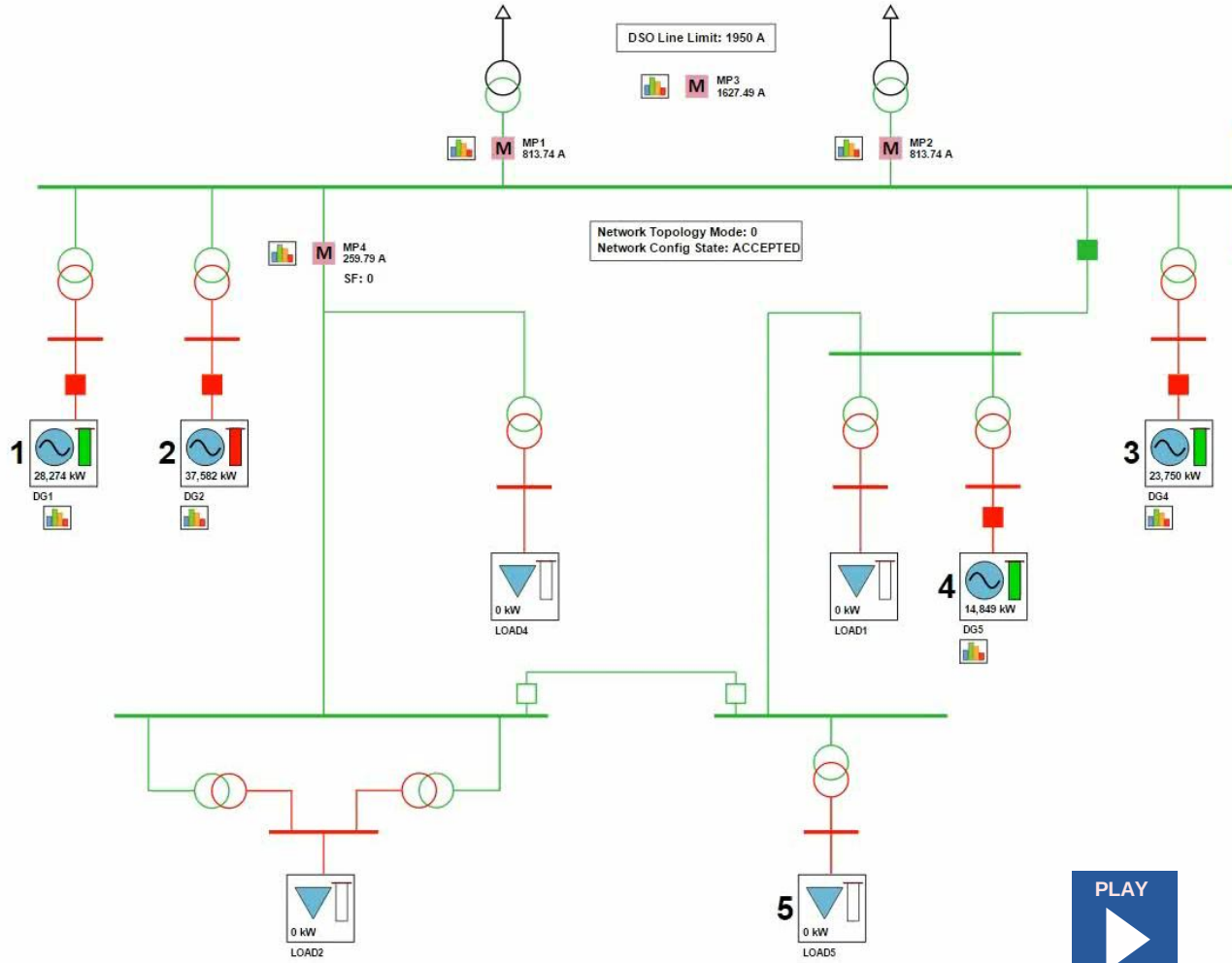
MP3 Measured Current





PLAY

Menu

ANM System In Service

HMI In Service Requested

Change

SCADA In Service Requested

User: Admin

Roles: Admin

IP Addres

HMI Vers

Go back

Use Cases

Reduced Deviation from Schedule for Utilities
Reduced Curtailment of RE for IPPs

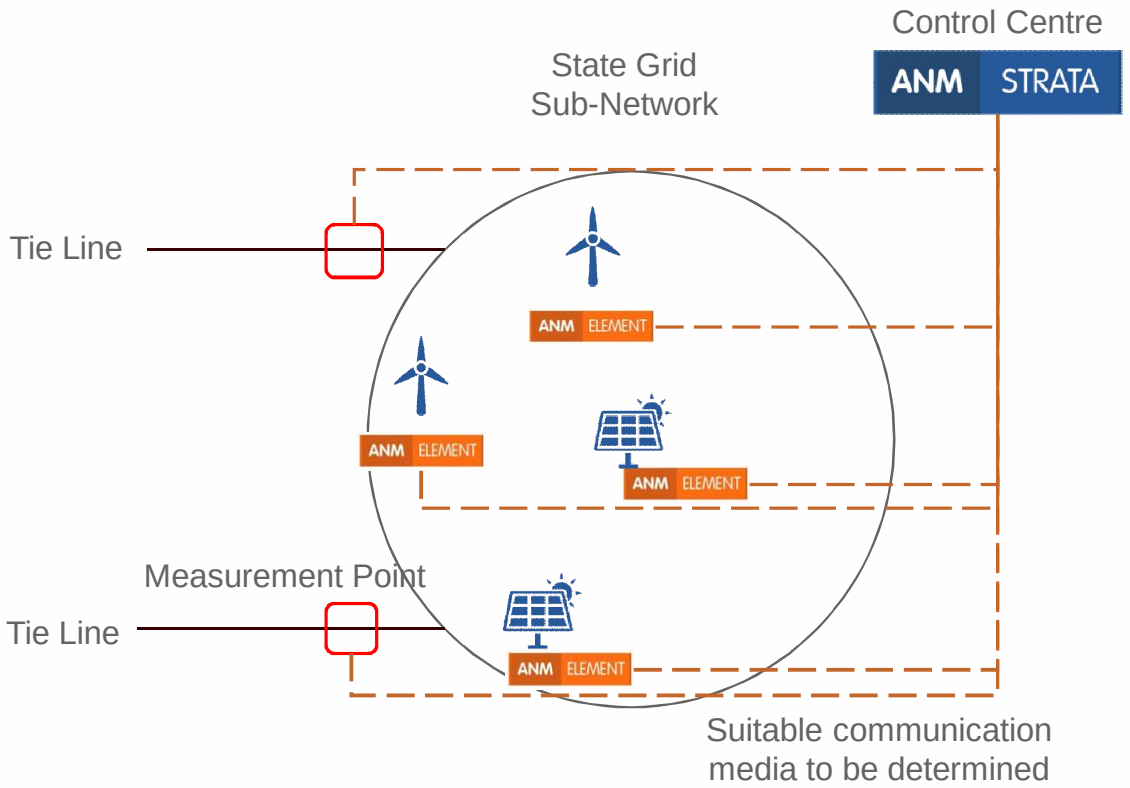
Real-time/granular control of REs based on individual impact

such that

Tie-line power flow remains within limits

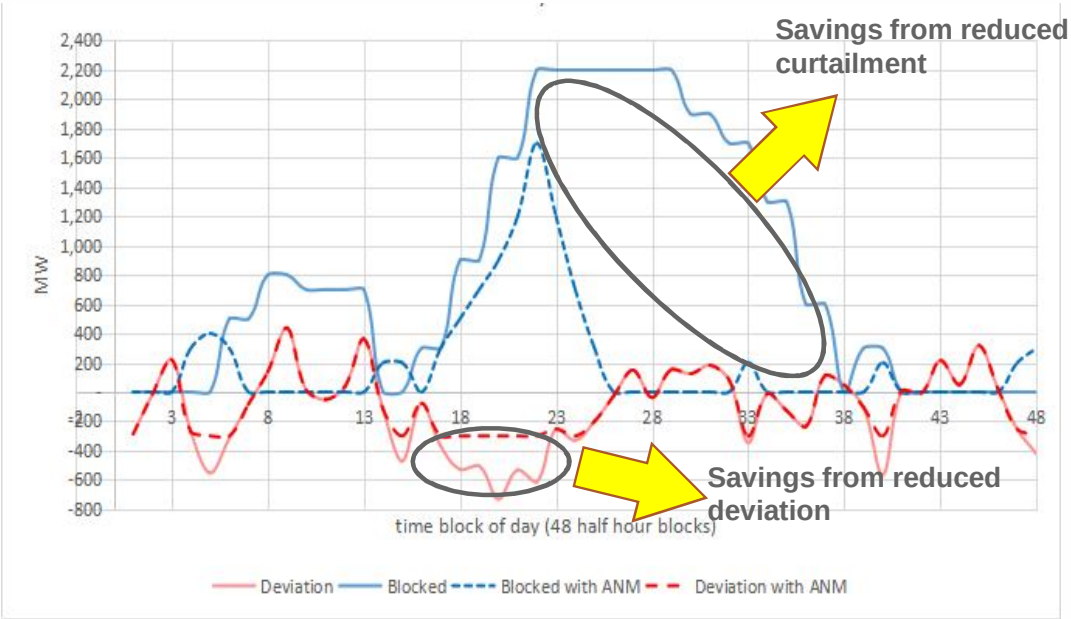
Benefits:

- Over/Underdrawal within tighter limits → Reduced deviation penalty charges
- Reduced/eliminated curtailment (if any) of RE → higher revenue for IPP



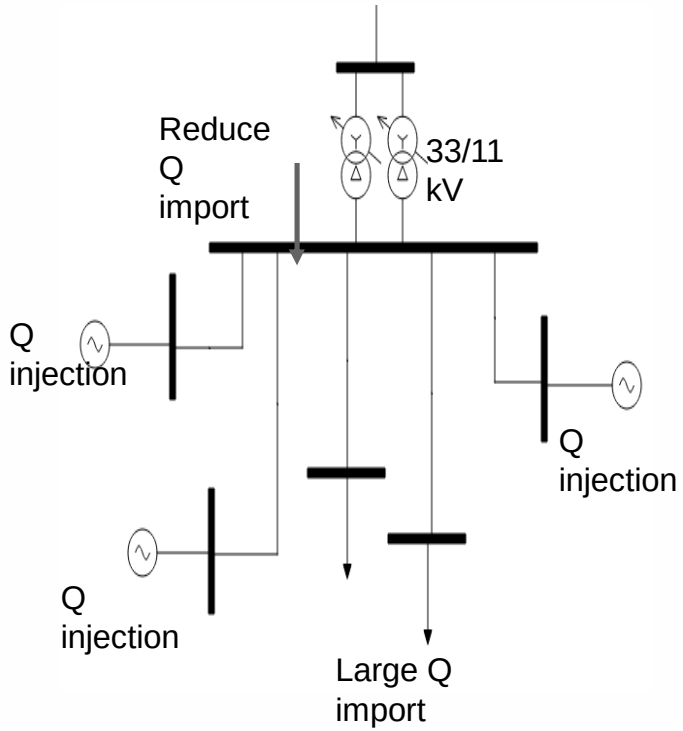
Reduced Deviation from Schedule for Utilities

Example Benefits for a Utilities and IPPs



Dynamic Reactive Compensation With Renewables

- Solar and Wind plants have the capability to generate both real and reactive power simultaneously
- ANM helps harness this capability
- Implement feeder/substation/ sub-network/network level Dynamic Reactive Power Control



Benefits:

- ↓ Technical Losses (feeder and transformer)
- ↓ CAPEX purchases – cap. banks
- ↑ Real Power transmission capacity (reduced congestion)
- ↑ Voltage Control
- ↑ RE penetration

Reactive Power Management Without Affecting Real Power Generation

Increased Hosting Capacity

Client: Scottish & Southern Electricity Networks

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Orkney ANM

Background/Challenge

Scottish and Southern Energy Distribution (SSEPD) sought cost effective alternative to traditional grid upgrades (new subsea cable) to accommodate high demand for wind generator connections, despite network being at full capacity

Solution

Actively-managed grid connections for distributed generation using Active Network Management

Benefits

- Operational since November 2009
- **Allowed additional 20 generators (24 MW) to connect**
- **Project developers saved £30 million**

Orkney Isles Background Information

- 70 islands off North coast of Scotland
- ≈1000 sq km and 21,000 inhabitants
- Winter peak demand of 31 MW
- Summer minimum demand of 6 MW
- Connected to mainland UK via 33kV subsea cables

Generator	Size (MW)	Production Factor *after* Curtailment
1	0.9	37.1%
2	2.3	47.7%
4	4.5	45.4%
5	0.9	37.2%
6	0.9	40.1%
7	0.9	40.8%
9	0.9	31.8%
10	0.9	34.0%

View the live system:

http://anm.ssepd.co.uk/

Scheduling and optimisation of Islanded Networks

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Shetland Microgrid

Background/Challenge

The Shetland Islands are electrically isolated from mainland UK, and have a reliance on old, inefficient diesel generation. There is a contractual arrangement with an existing gas terminal and 3.6 MW of wind. There was no capacity for more renewable generation.

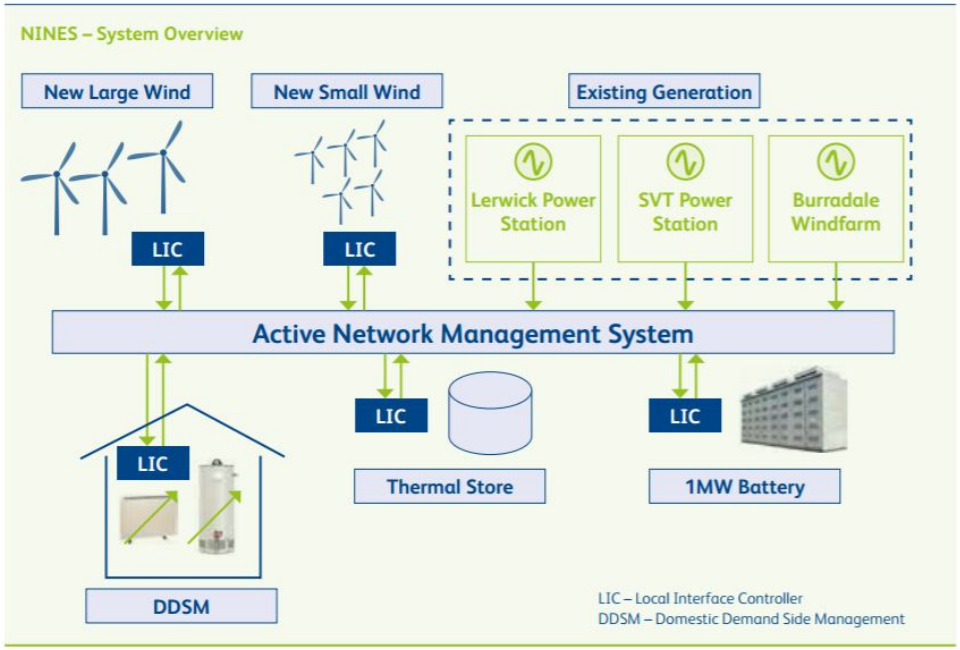
Solution

ANM system deployed to smooth demand curve, utilise available technologies, maximise renewable generation capacity, and alleviate constraints, lop peaks, and fill troughs. The system controls: energy storage, domestic DSM, wind and tidal generation. It incorporates scheduling into the control.

Benefits

- **8.5 MW** of renewable generation connected on to the Shetland Network
- **Extra 9.32 GWh** of renewable energy generated on to the network (March 2016 – February 2017), **10% of demand** and saving **£1.0m per annum**

System Architecture



Asset Utilisation

Client: UK Power Networks

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Challenge

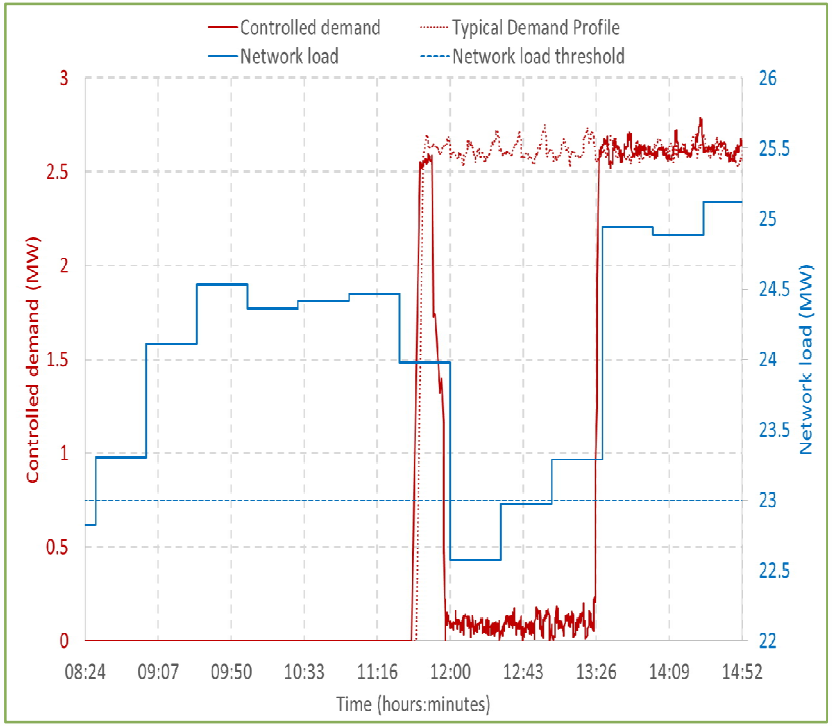
Need to integrate variety of different DR assets managed directly and indirectly to provide peak load relief.

Solution

ANM to manage EV charging networks, DG assets and multiple aggregators. Total of ~70 different DR assets across 5 constrained transformers.

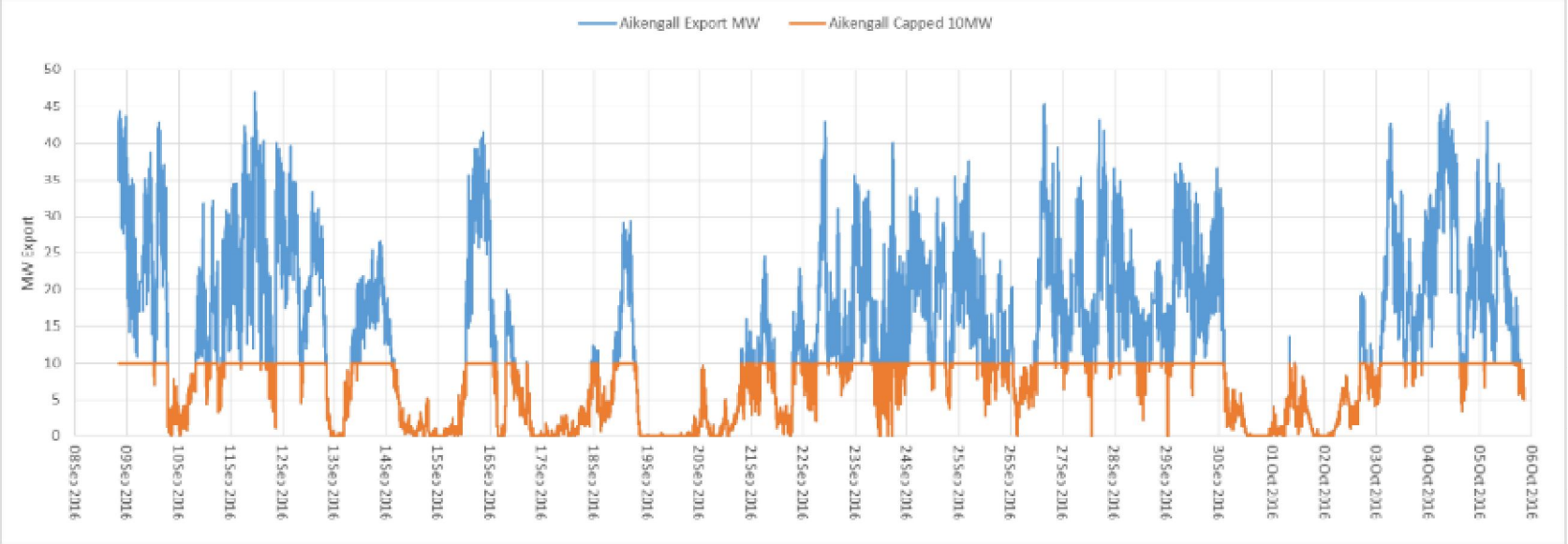
Benefit

~£50m saving for replacement transformers



Avoiding Outages and Curtailment

Client: SP ENERGY NETWORKS



- Existing firm generator had 10 MW cap under N-1 conditions at GSP transformer
- ANM deployed retrospectively to actively manage generator under N-1 conditions
- Increased energy yield (the energy under the blue line – the orange line is the export with a SPS)

Thank you