GE VERNOVA

- DERMS: BOOSTING GRID FLEXIBILITY AND EFFICIENCY
- DERMS CHALLENGES FOR DISCOMS DER REGISTRY: LAYING THE GROUND WORK FOR DERMS
- DERMS JOURNEY
- GLOBAL INSIGHTS TO LOCAL SUCCESS
- CYBERSECURITY FOR DERS, EVS, AND SMART GRIDS

Just imagine if a Grid Operator had a tool providing

- Visibility to all the DERs on the grid

- Every 15 minutes:
  - Runs powerflow [now + coming hours]
    - Identify upcoming violations
    - Computes what limits should DERs respect to solve violations
  - Sends these limits out to every DER

- Tool reports that everything is fine
  - Grid is safe
  - DERs are under control
  - Cost of dispatching DERs is minimized

Challenges | Why DERMS

GE VERNOVA

UTILITY GOAL:

NET ZERO

Electrification

Renewables
(Large and small scale)

CHALLENGES:

Network capacity issues
- EVs/heating adds 50-100% to the load

New electrical patterns
- Backfeeds
- High voltages
- Protection Issues
- Balancing
- Intermittency across T&D

AEMO

New stakeholders
- Rapid proliferation of aggregators and DER service providers

New regulations
- FERC 2222
- EU Network Code Reform for Demand Response

CHALLENGES:

Voltage Quality of Service

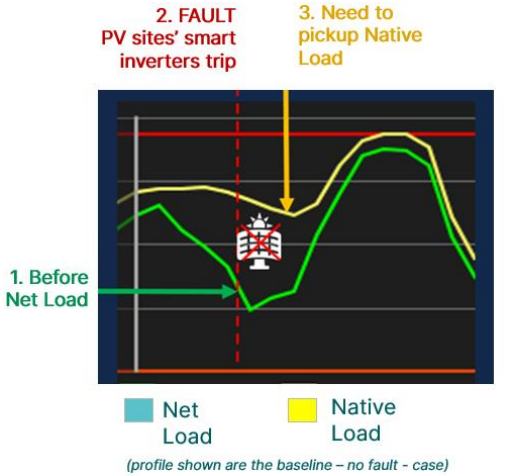
- x1000s of Over & Under Voltages

STEDIN | FOR THE NEW ENERGY GENERATION

- Minimum load, high generation – surplus of power, causing voltage to increase
- Peak load, no generation – e.g., cloudy days, resulting in deficit of power and causing voltage to decrease
- Voltage fluctuations lead to significant impact on equipment and QoS

CHALLENGES:

Reliability & CAPEX
- Keeping SAIFI/SAIDI levels despite DER hidden load in Distribution
- Generation load exceeds Xfmr capacity



Are DERs a challenge, or a part of the solution for grid operators?

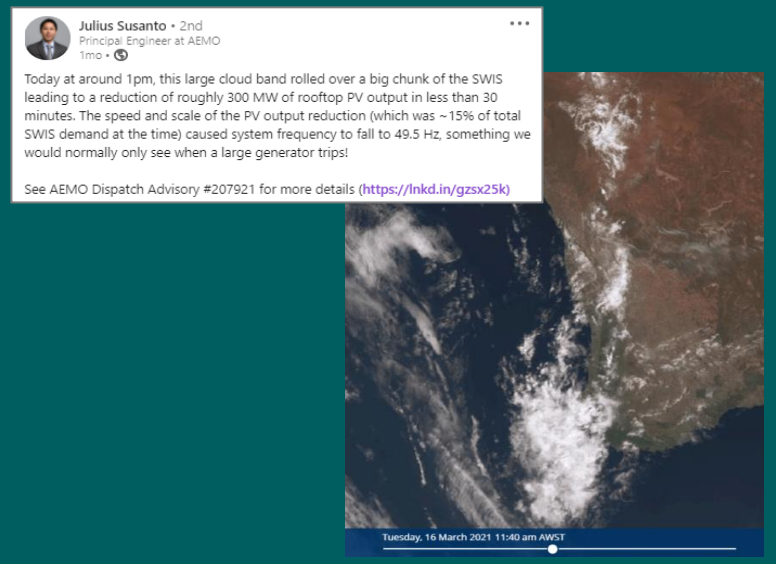
DER Challenges to Grid Operation – Transmission, T&D

GE VERNOVA

AEMO (AUS): DERs impacting Transmission

March 16th 2021, sudden cloud cover

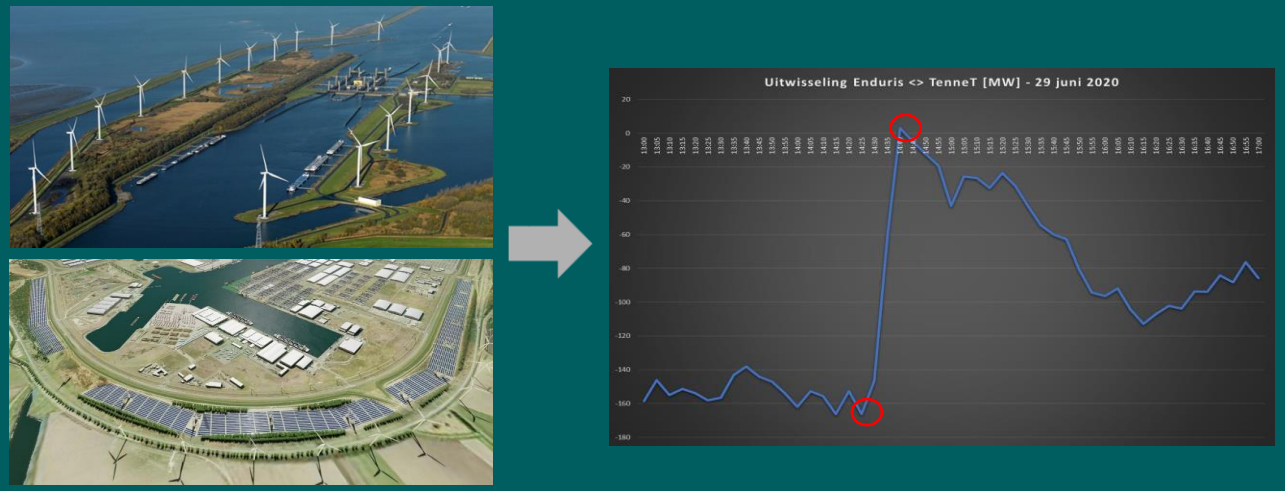
- 300 MW drop in rootfop PV (Distribution)
- frequency drop to 49.5 Hz (Transmission) equiv. to when 1 large Generator trips



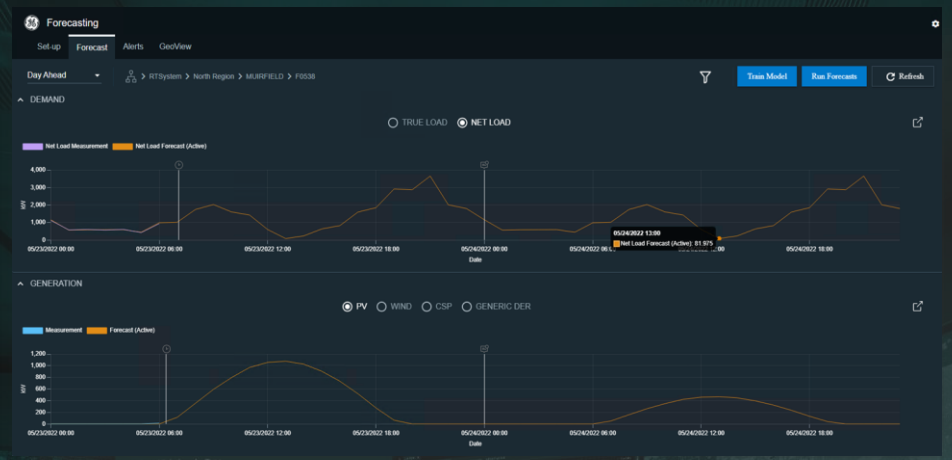
Stedin (NL): Bulk RENs impacting Distribution

June 27th 2020, strong wind, ideal T°C

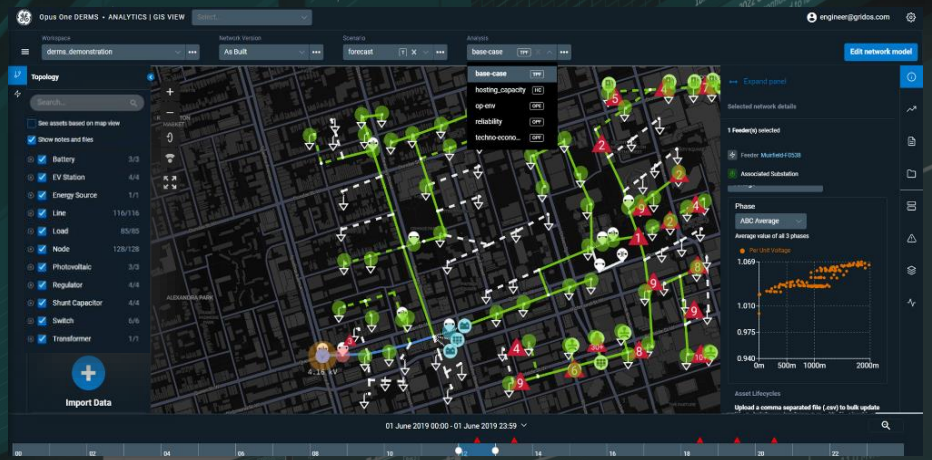
- Bulk Wind & PV generation peaking
- Transmission imbalance
- TSO asking DSO to curtail 140 MW of DER generation



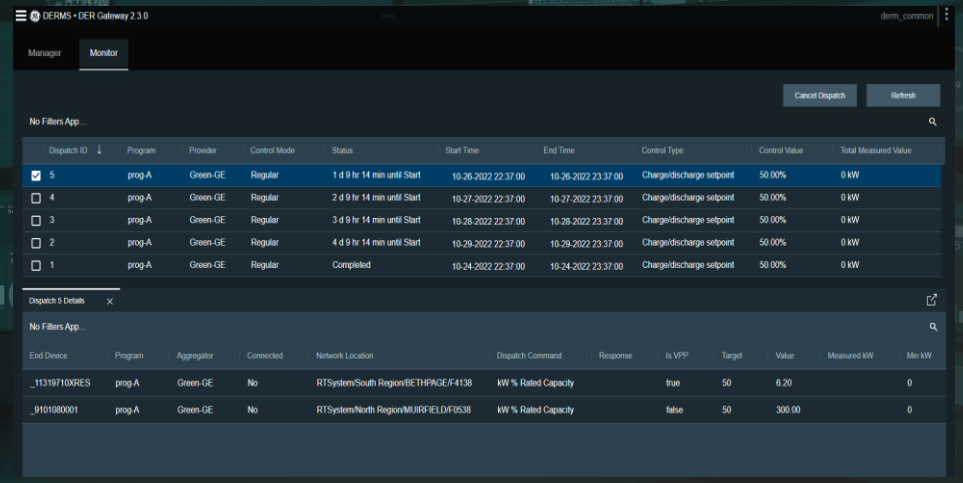
Typical DERMS Workflow



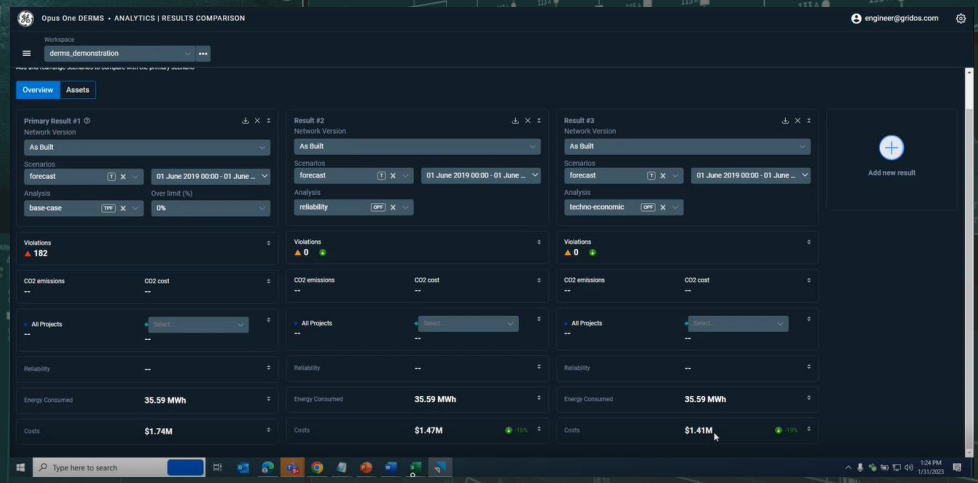
Forecast Load and Generation



Identify Violations



Dispatch DER and Track Performance



Optimize, Analyze and Compare

Use Case spotlight: Planning for Flexible DER Interconnection

GE VERNOVA

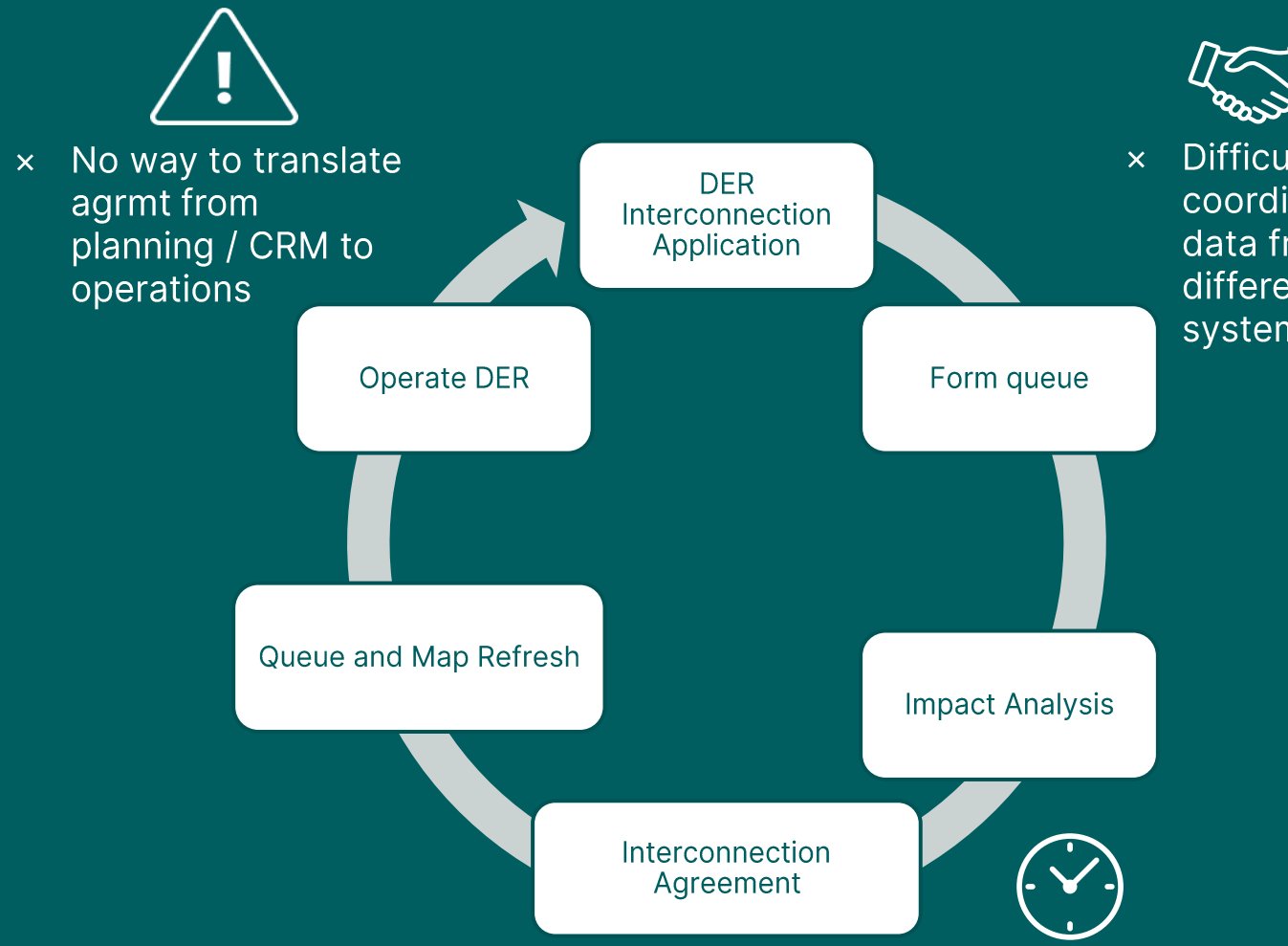
Pain points are felt with current DER Interconnection solutions

Speed - Grid operators are outpaced by DER grid connection requests.

Data - Coordinating data from customer portals and different internal departments is difficult.

Flexibility - Hosting capacity is overly conservative or quickly stale due to highly dynamic nature of the queue.

Plan-to-Operate - Few hooks between DER interconnection agreements generated through impact analysis to the operation of DER once connected.



Global Success

GE VERNOVA

Australia
Dynamic Connections reduce curtailment and maximize customer and network asset utilization

- DER registration, provisioning, and commissioning
- Dynamic Operating Envelope

West Coast Utility
Aggregated dispatch + granular monitoring

- Identify violations
- Gateway send VPP dispatch signals
- DERA disaggregates

Worldwide
ADMS – Energy Insights & Integration

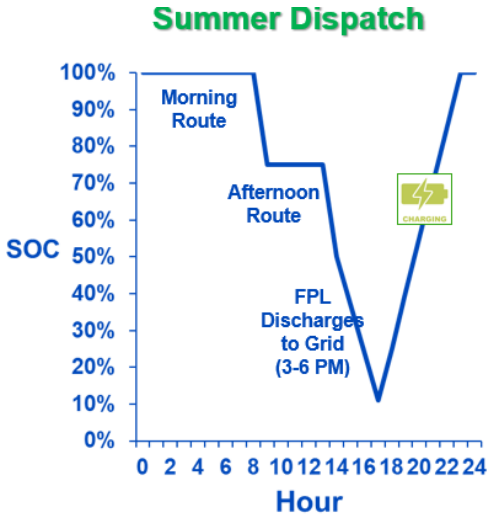
- Real-time DER data to be displayed in ADMS
- Look-Ahead Analysis

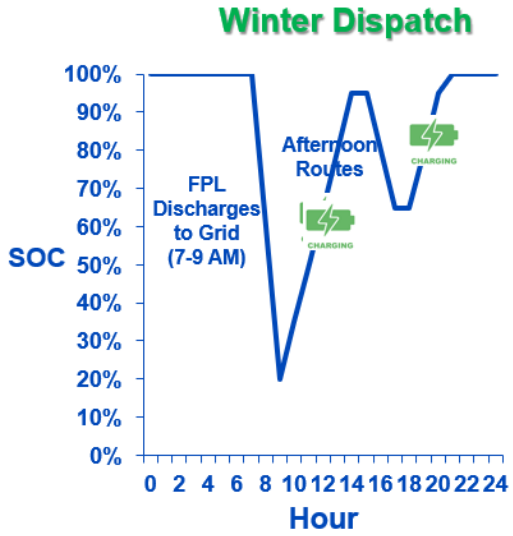
Norway
Grid specific Data Fabric
Discover, Govern and Utilize data

- Duration Curation/ VEE
- Exploratory Data Analysis
- Discover & Use *dark data*

V2G with Electric Buses

- Pilot with Florida Power and Light (FPL) explores technological, commercial applications of V2G ahead of mass adoption
- Creates blueprint for ~9,000 school buses in FPL territory
- Five buses with batteries available for utility use via connection to charger
- Two with 132 kWh batteries
- Three with 80 kWh batteries
- City of West Palm Beach will own, operate buses
- FPL will own, pay for bus batteries & charging stations
- City to provide FPL access during peak demand periods
- When buses aren't transporting students, FPL will command them to export power to the grid during peak demand
- Using GE DER Gateway integrated with ADMS for communication with EV bus aggregator.





Control Room of the Future

The Control room of the future will be:

Proactive vs reactive

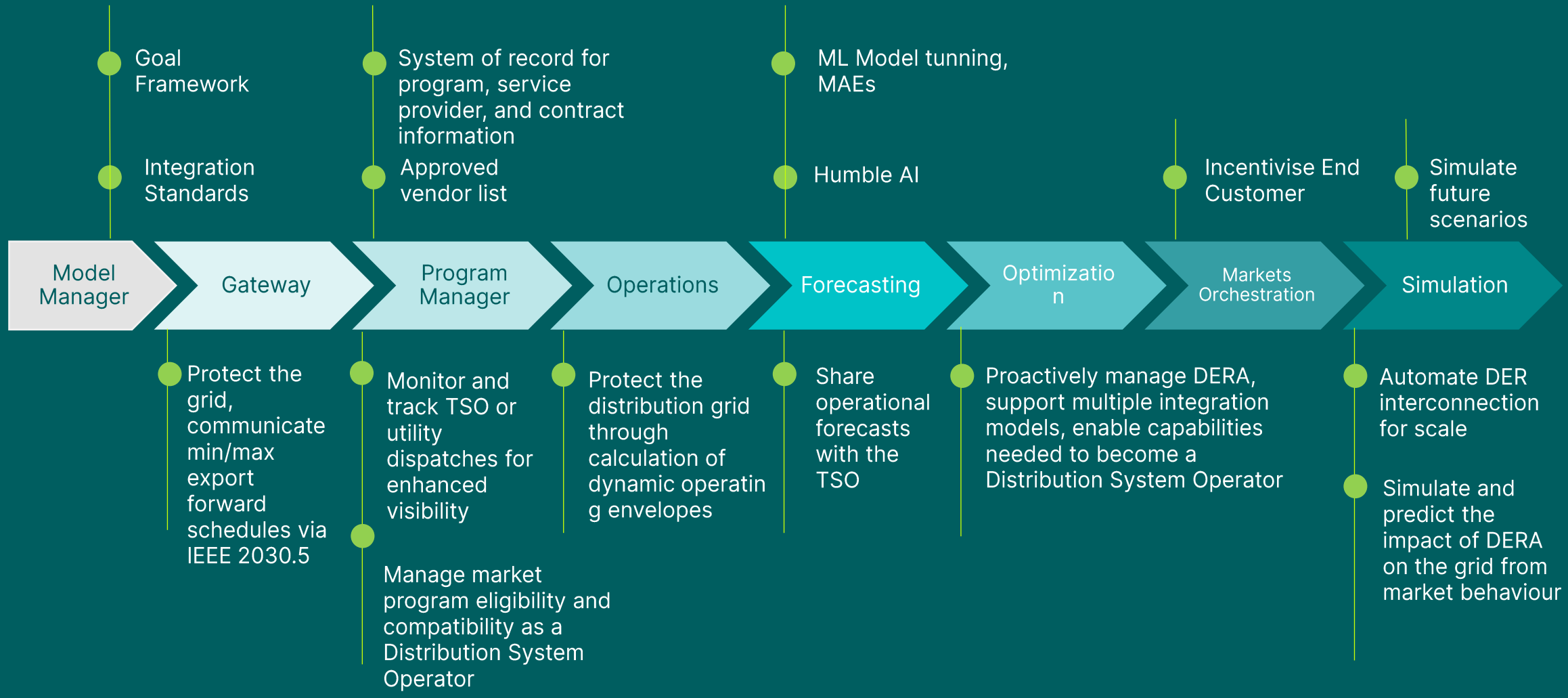
Require fewer operators

Provide a whole wide view of network operations

Will enable net zero

Will achieve all this without a massive investment in grid HW infrastructure

DERMS Journey for DISCOMS



ZERO TRUST ARCHITECTURE

GE VERNOVA

GridOS has adopted Zero Trust grid security model, addresses fundamental principles found in the NIST guidelines when developing a Zero Trust architecture:

Continuous Verification

In zero trust architecture, trust is never assumed based on a request's location or source. All interactions with systems, services, applications, and the like are subject to rigorous verification, regardless of the source.

Least Privilege Access

Access privileges are granted on a strict need-to-know or need-to-have basis. Users and devices are given the minimum access required to perform their task(s).

Network Micro Segmentation

(Utility)

Utility networks must be segmented into smaller, isolated zones. This proactive containment strategy limits where accounts can move between networks or systems (e.g., lateral movement).

Strict Identity Verification

Identity verification is a cornerstone of a solid zero trust implementation. Strong identity and access management practices ensure that only authorized devices and individuals access the *right* resources.

> Zero Trust is a strategy, a principle and not a set of tools. It can be a significant shift for some organizations, overhauling legacy processes for long-term prevention and mitigation.

GE VERNOVA

THANK YOU