Power Monitoring Expert Application

Toyota Motor Manufacturing Canada

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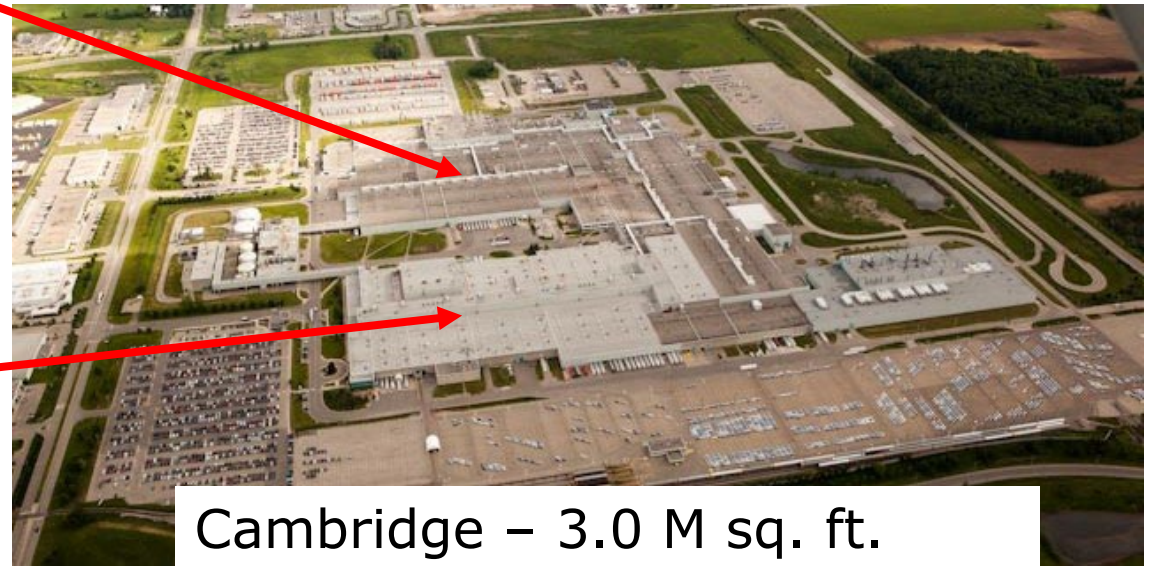
Woodstock & Cambridge Facilities

West Plant
RAV4
RAV4 Hybrid

North Plant
RAV4,
Lexus NX

South Plant
Lexus
RX 350, RX 350h



Woodstock & Cambridge Facilities

1988 Corolla with our 10,000,000 vehicle – a 2022 Red Lexus NX

- Approximately 8,500 employees
- Produce over 500,000 vehicles annually

Woodstock Facility

- Factory Built in 2007
- Direct Connected to Hydro One
- Demand 14 MW to 22 MW
- 7 Switch Rooms

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Woodstock Facility

25 Substations

- Schneider Square D - QED
- 2,500 to 3,500 kVA
- 3 x 5 kV Subs, 5,000 kVA

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Woodstock Facility

Meters

- CM4250
- PM8000
- ION 9000 for incoming power

Breakers

- Masterpact NW with Micrologic 6.0 P control units


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9
9
8
DASHBOARDS
DIAGRAMS
TRENDS
ALARMS
REPORTS
SETTINGS
Diagram Library
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TMMC WOODSTOCK
Plant Total : 14,856 kW
NPE
ED : 1,669 kW
SS 7-1
SS 2-1
SS 2-2
SS 3-1
SS 3-2
SS 3-7
SS 3-8
SS 3-9
SS 3-5
SS 3-6
SS 6-1
SS 1-1
SS 1-2
SS 1-3
SS 1-4
SS 1-5
Plastics : 1,610 kW
Utilities 5 kV
Air Compressors
Chillers
Press : 625 kW
SS 3-3
SS 3-4
SS 4-1
SS 4-2
SS 4-3
SS 4-4
SS 4-5
Weld : 2,052 kW
Paint : 3,424 kW
Penske Cross Dock
SS 5-1
SS 5-2
13.8 kV Bus
Assembly : 1,702 kW
Compressed Air
Natural Gas
Steam
Chilled Water
Water

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Woodstock Facility - Architecture

- PME 2020
- Installed on a VMware server
- Meters are Ethernet connected
- Breakers are connected to the meters via Modbus
- Meters are on 3 Facility VLANs operating over the plant LAN

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Woodstock Facility - PME

- Users:
  - Facility Engineering and Maintenance
  - Production Shop Engineering and Maintenance

- Most Used Modules:
  - Diagrams – Real Time Operations
  - Reports – Energy Billing to the Production Shops

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Woodstock Facility – PME Diagrams

- Real Time Operations
  - Loading Studies
  - Non-Production Energy (NPE) Consumption
- Identifying Capacity on Bus Ducts, Power Distribution Panels (PDPs)
- Power Studies
  - Identify and Confirm Savings (M & V)
  - Look for Power Anomalies

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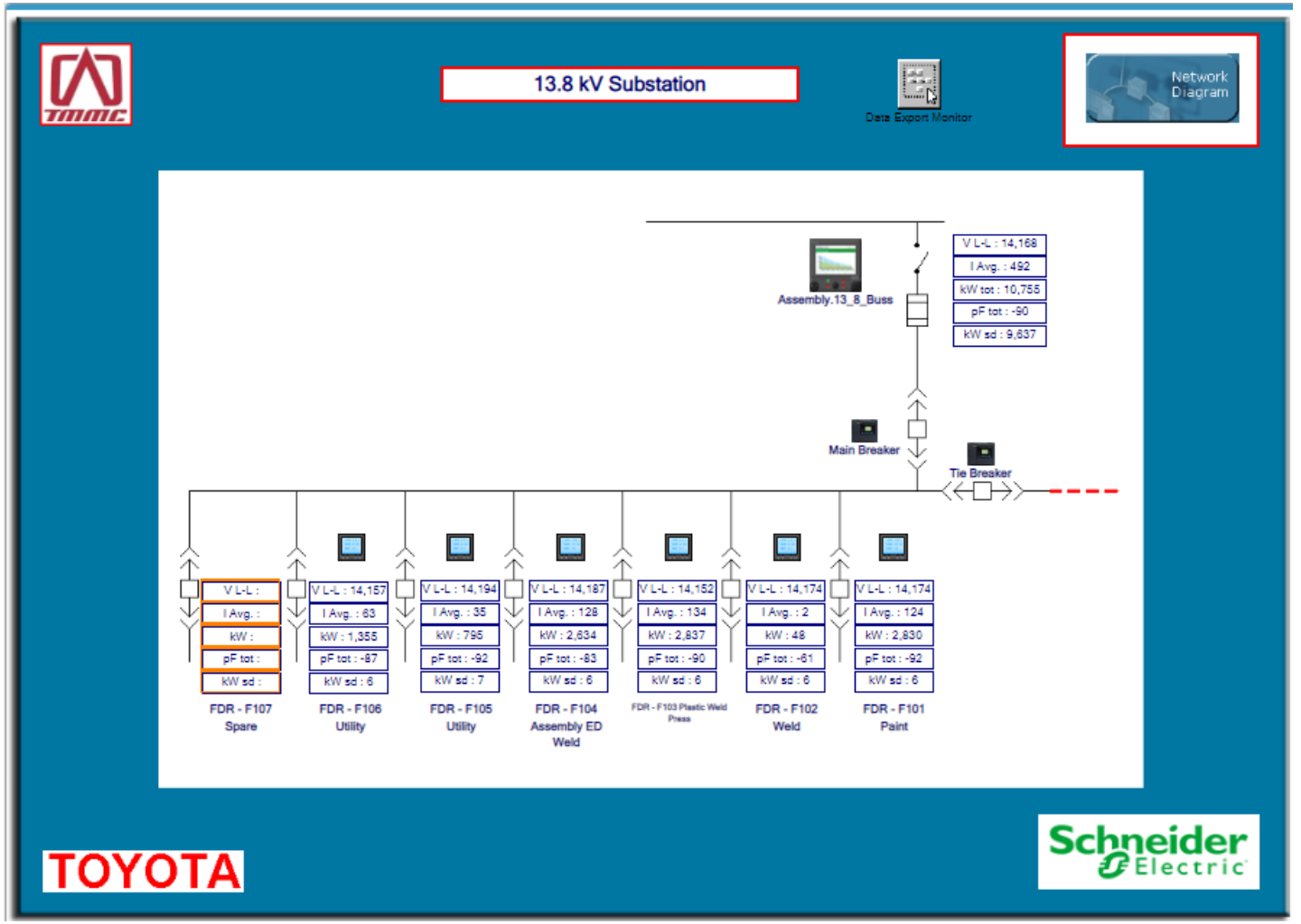
Woodstock Facility – PME Diagrams

- Incoming 13.8 kV Power Distribution



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Woodstock Facility – PME Reports

- Generated Monthly
  - Provide Billing Data for Production Shops
  - Provide Data to Environmental for Tracking and Reporting

- Generated Weekly
  - NPE Data for Production Shops

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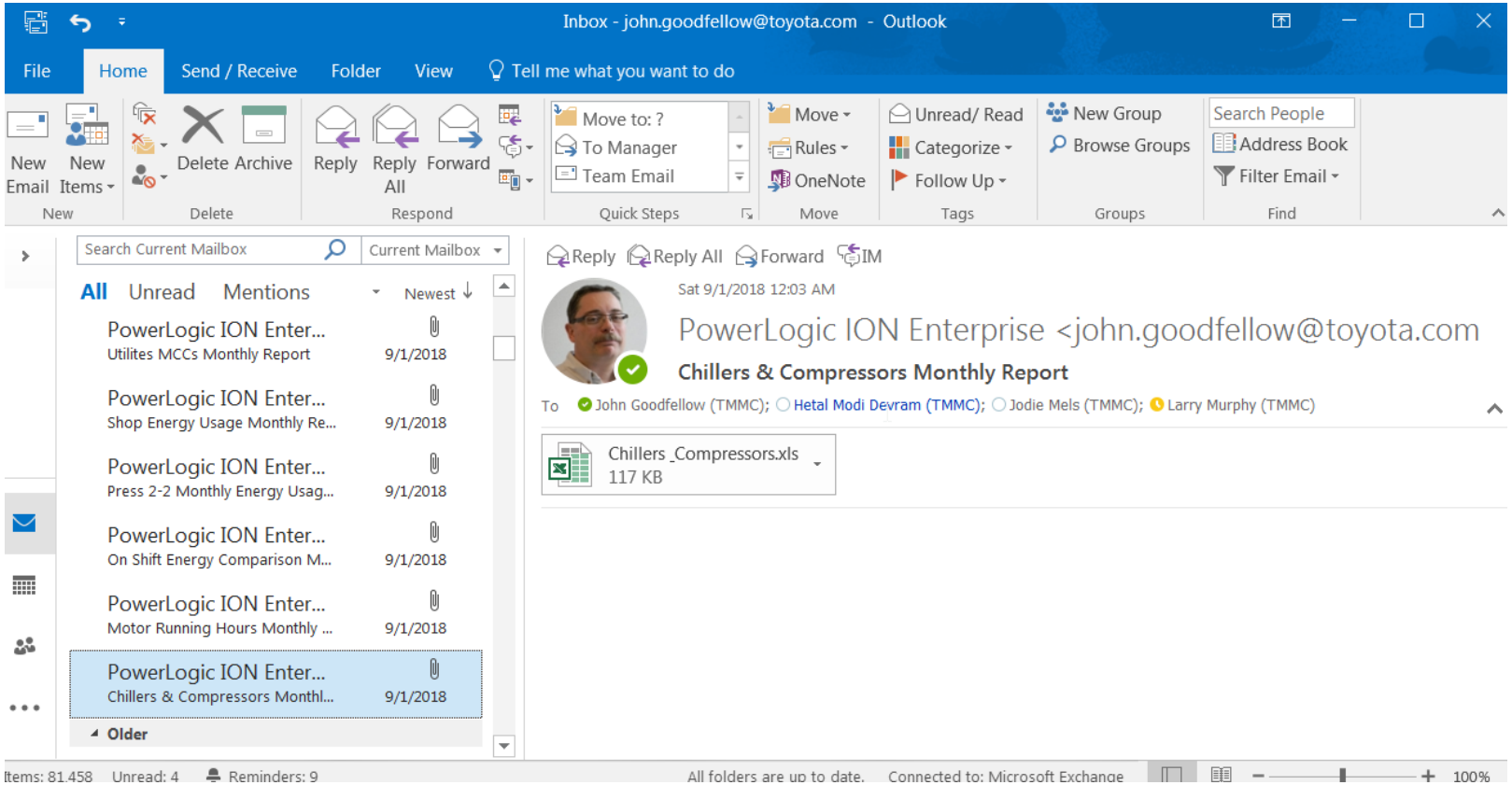
Woodstock Facility – PME Reports

- Run Automatically and Distributed via Email
- Distributed Reports in Excel format



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Woodstock Facility – PME Reports

- Shop usage for accounting billing purposes

Schneider Electric

Energy Usage By Shift Report

9/1/2018 12:00:00 AM - 10/1/2018 12:00:00 AM (Server Local)

September/2018

Source	Shift 1 (kWh)	Total (kWh)
Assembly.13_8_BusF103PlasWeldPressMtr	2,001,795.52	2,001,795.52
Assembly.13_8_Buss_F101_Paint_Mtr	2,242,540.10	2,242,540.10
Assembly.13_8_Buss_F102_Weld_Mtr	240,301.34	240,301.34
Assembly.13_8_Buss_F104_Weld_Mtr	1,859,912.03	1,859,912.03
Assembly.13_8_Buss_F105_Utility_Mtr	1,587,832.92	1,587,832.92
Assembly.13_8_Buss_F106_Utility_Mtr	985,928.81	985,928.81
Assembly.SS_5_1	438,037.74	438,037.74
Assembly.SS_5_1_MCC_5_1_3	46,418.00	46,418.00
Assembly.SS_5_2	448,235.11	448,235.11
Paint.SS_4_2	451,833.97	451,833.97
Paint.SS_4_3	360,188.52	360,188.52
Paint.SS_4_4	590,472.28	590,472.28
Paint.SS_4_5	424,902.86	424,902.86
Press.SS_2_1	149,187.47	149,187.47
Utility.Maint_T_1_1	345,869.36	345,869.36
Utility.Maint_T_1_2	723,852.52	723,852.52
Utility.Maint_T_1_4	554,136.12	554,136.12

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Non-Production Energy Challenge

- Support TMC Non-Production Energy (NPE) Goals

- 45% Between Shifts
- 23% On Weekends

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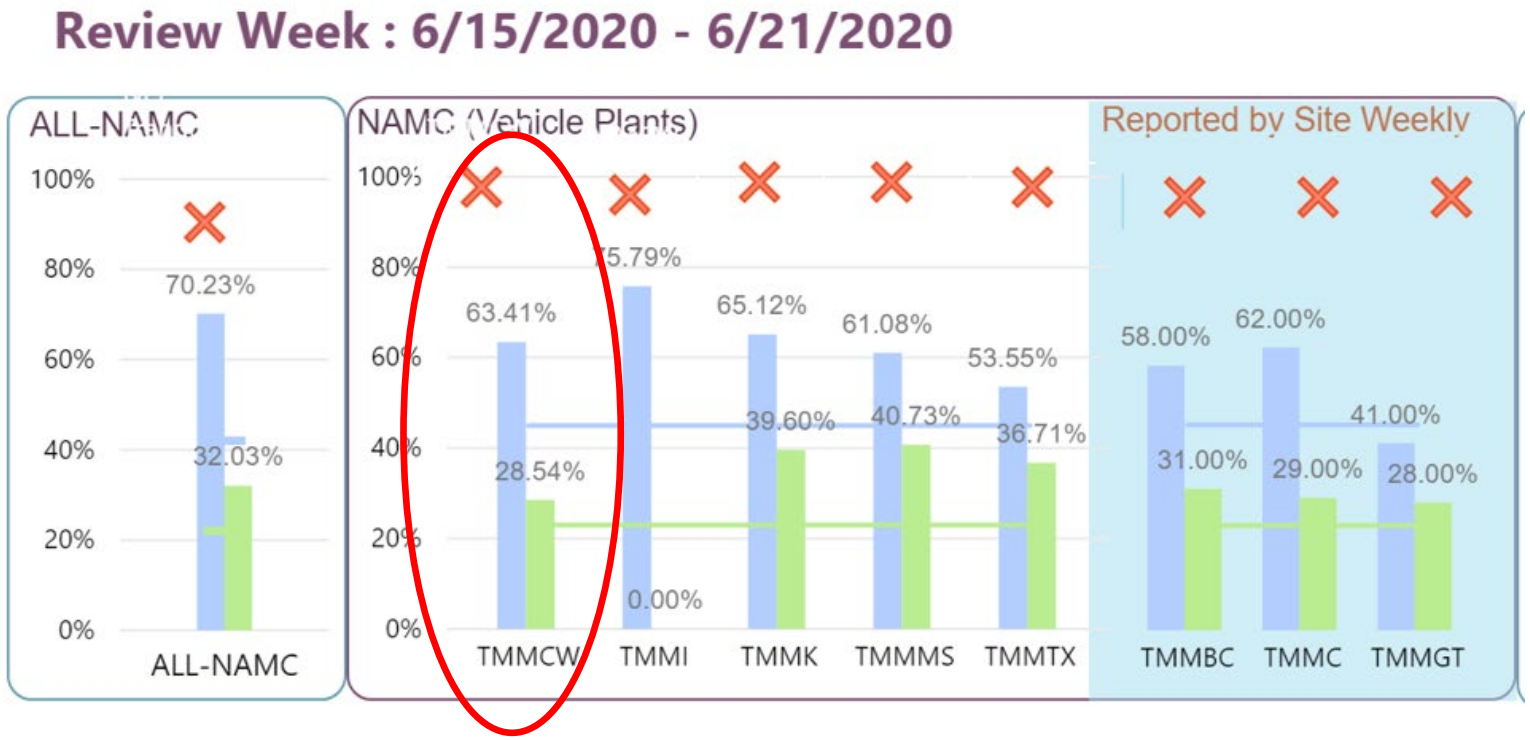
Non-Production Energy Challenge

NPE Goals:

- 45% Between Shifts
- 23% On Weekends

2020 GAP - **X**

- Not Meeting NPE Goals
- 63.4% Between Shifts - **X**
- 28.5% On Weekends - **X**



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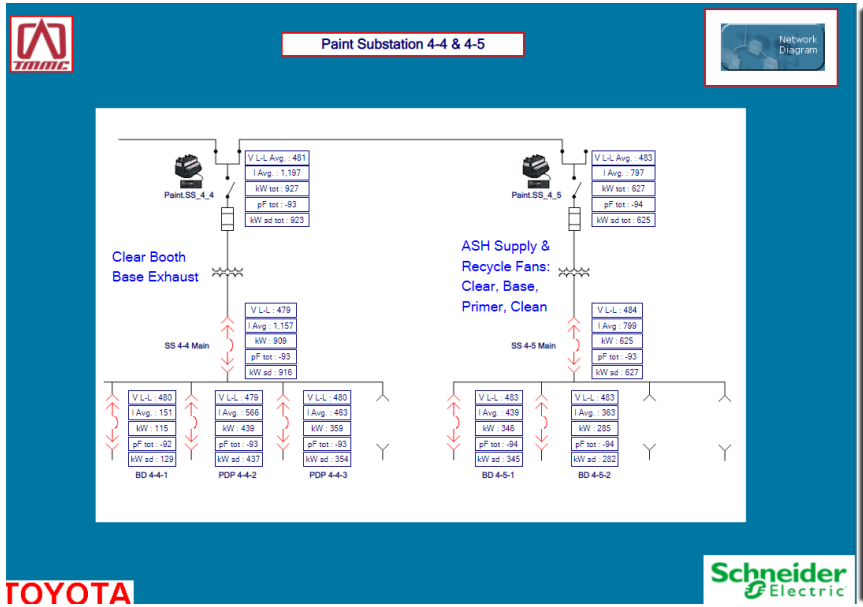
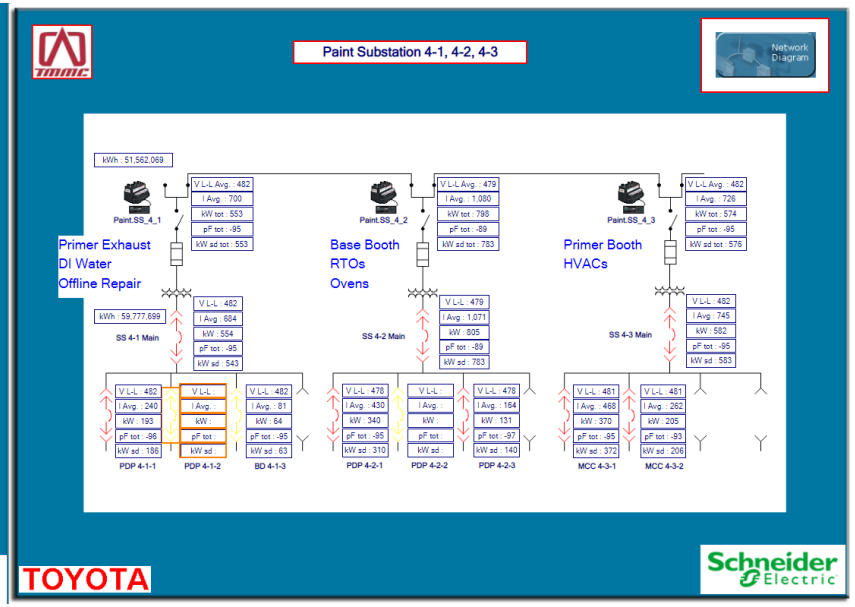
Non-Production Energy Challenge

Typical
Metering Pages:

Paint Shop –
5 Substations





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Non-Production Energy Challenge

- Metering pages supplied with Power Monitoring software are difficult to analyze in real time

- To achieve the NPE targets, Shop Maintenance and Production needed a tool to:
  - Summarize their shop electrical consumption
  - Make targets very visual with colour
  - Show real time data

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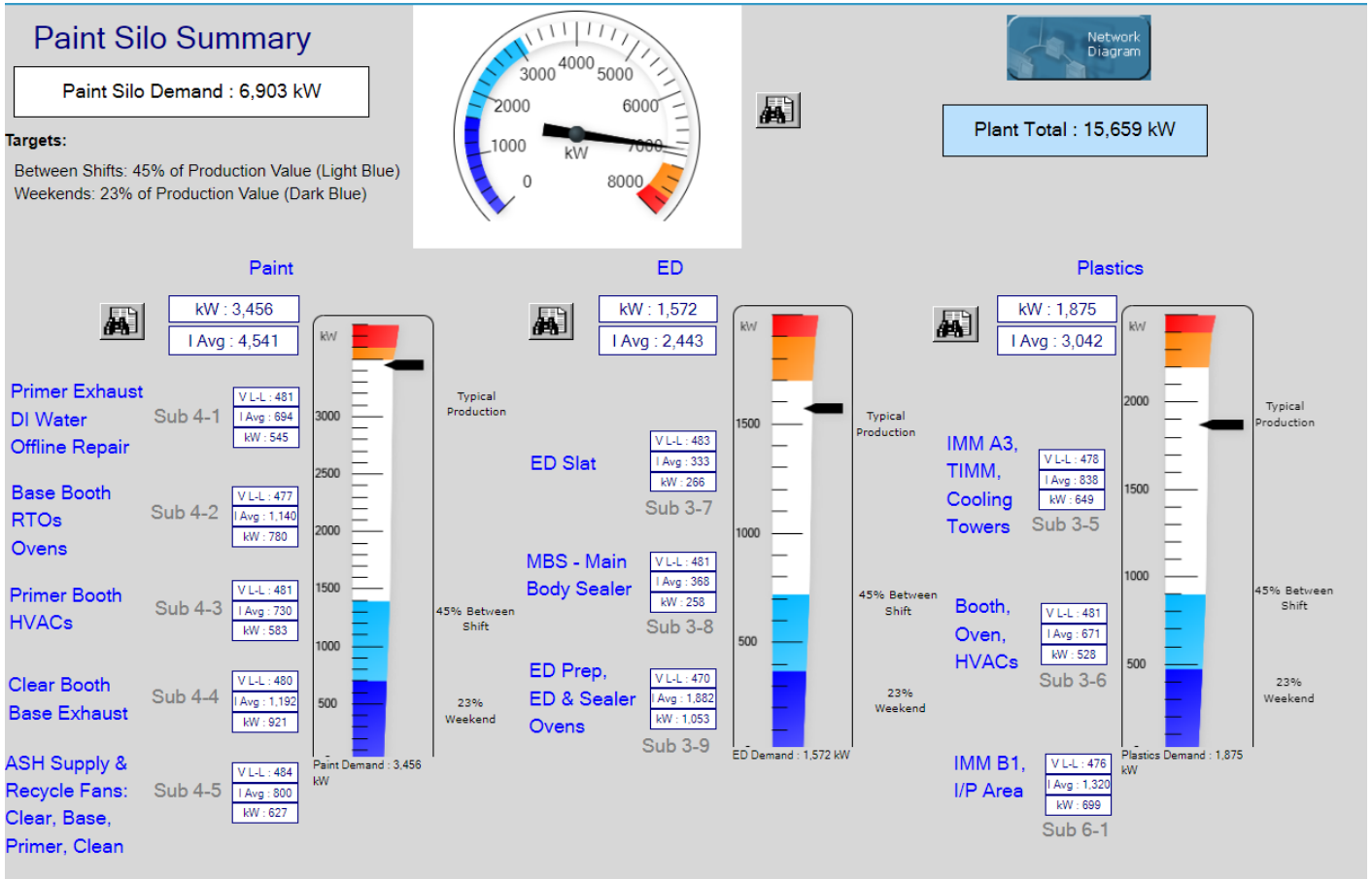
Non-Production Energy Challenge

KAIZEN: This *Paint Silo Summary PME* screen summarizes targets and electrical data from 3 shops and 11 substations



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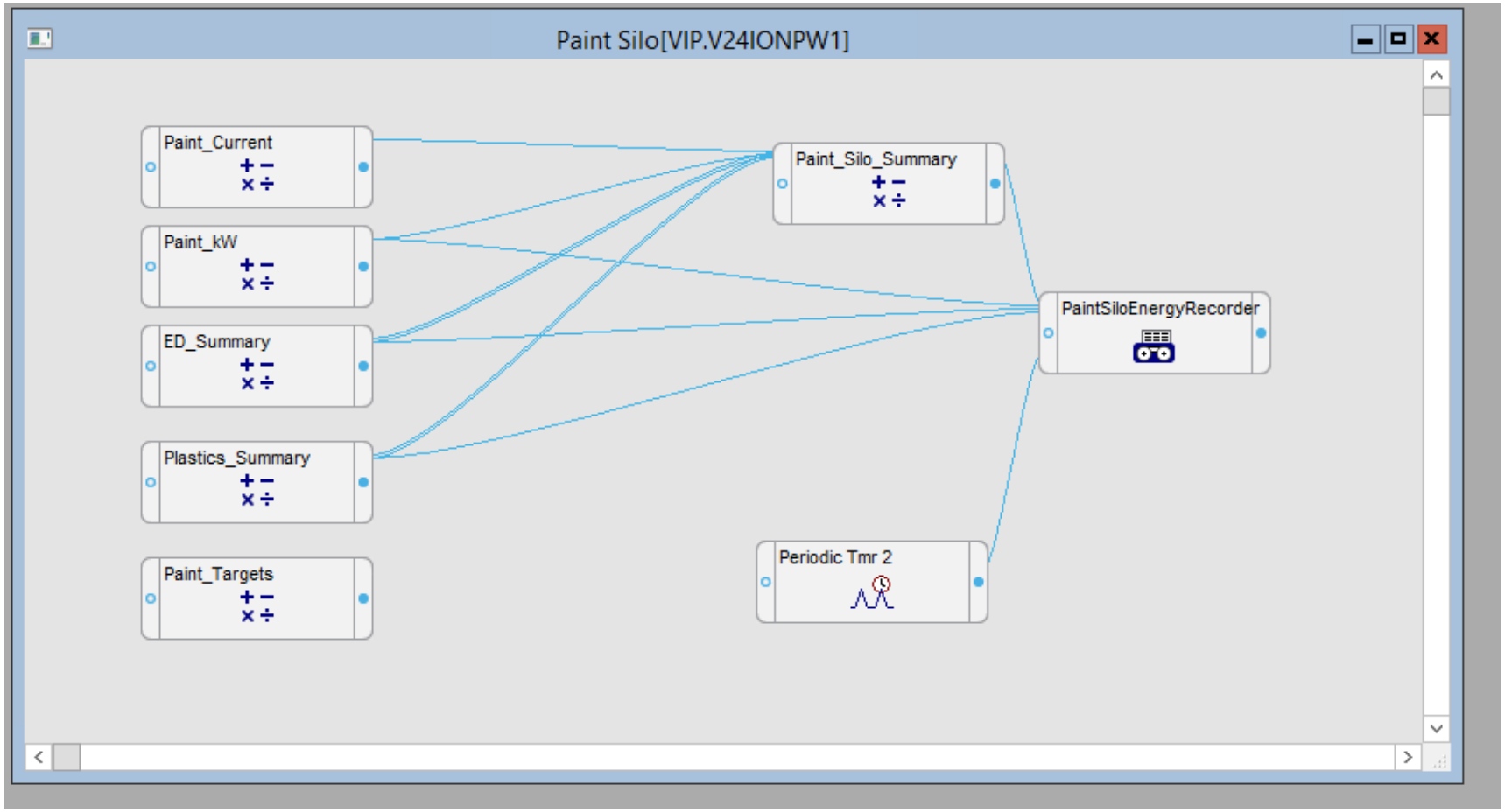
Non-Production Energy Challenge

Processed Meter Data In VIP for the Paint Silo Summary Screen



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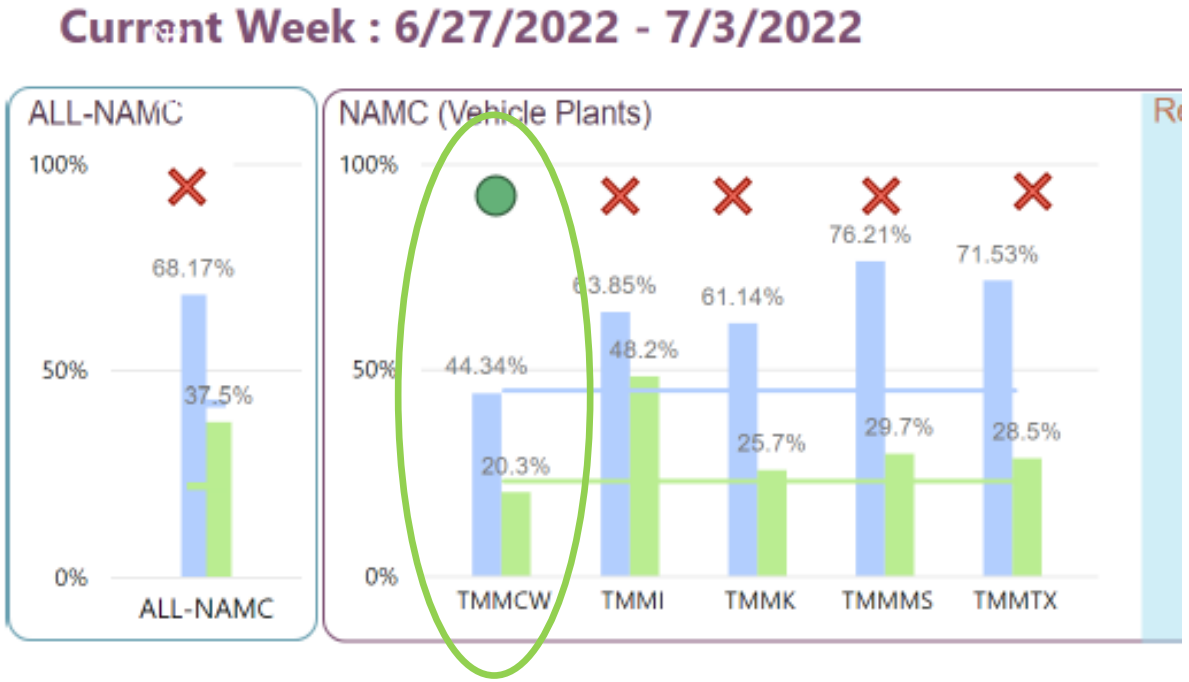
Non-Production Energy Challenge

NPE Goals:

- 45% Between Shifts
- 23% On Weekends

TARGET - O

- Met All NPE Goals
- <45% Between Shifts - 44.3% O
- <23% On Weekends - 20.3% O



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Woodstock Facility
Collection of Other Utility Data

Challenge:

- Gather Data from
  - Building Management System (BMS) - BACnet
  - Allen-Bradley PLCs – Ethernet I/P

- Present the data to PME over Modbus TCP

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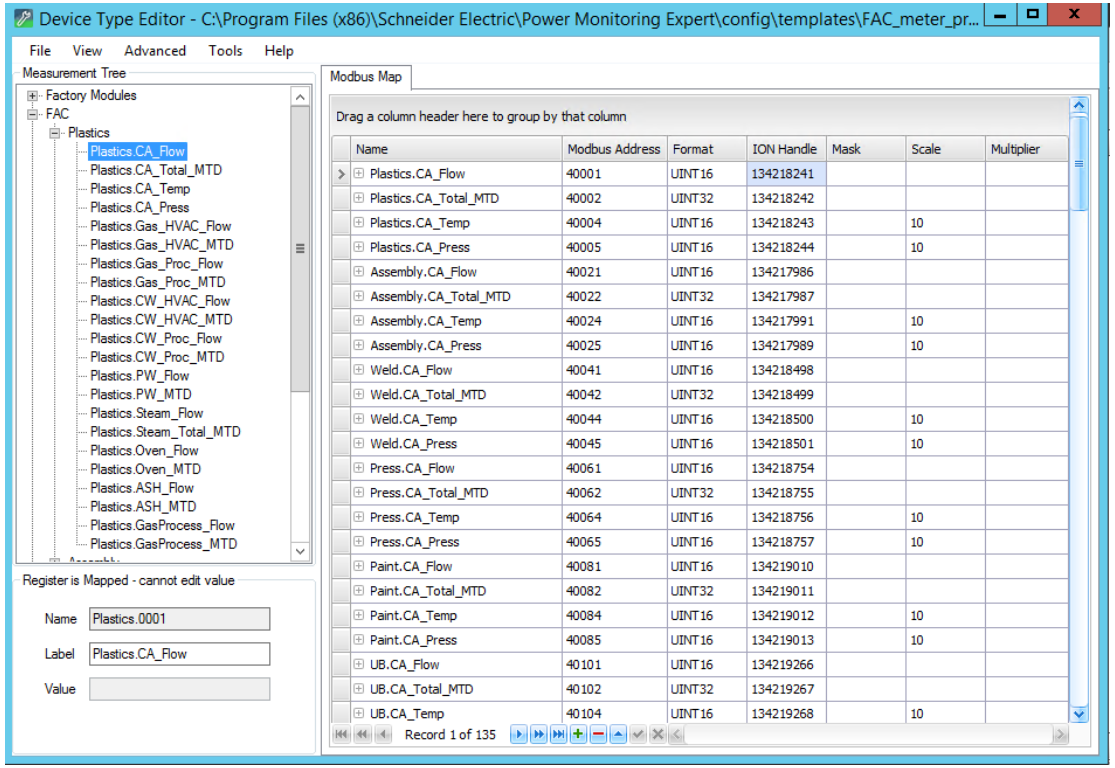
Woodstock Facility
Collection of Other Utility Data

- Used Device Type Editor to import non-power meter device data into PME



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- Developed a gateway to exchange data between systems

- Modbus to / from PME

- BACnet to / from JCI BMS

- AB Ethernet I/P from PLCs with flow meters

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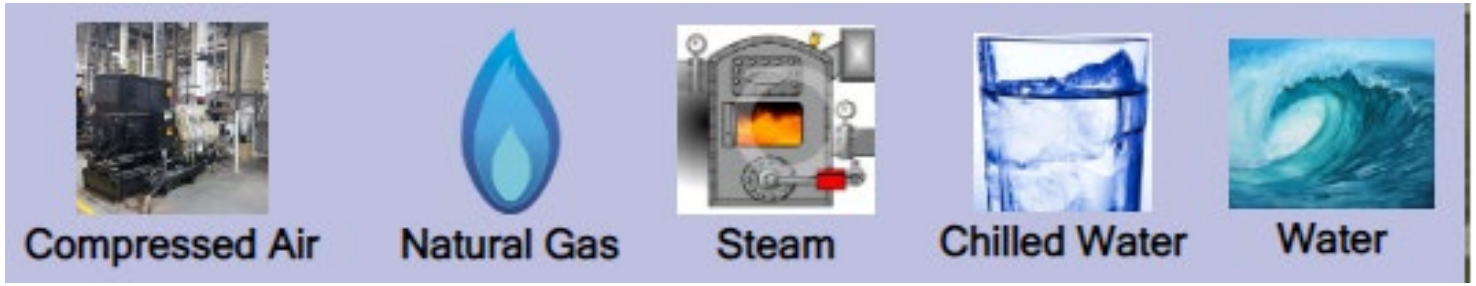
Woodstock Facility – Other Utilities

- New Menu Bar 0n The Woodstock Home Page



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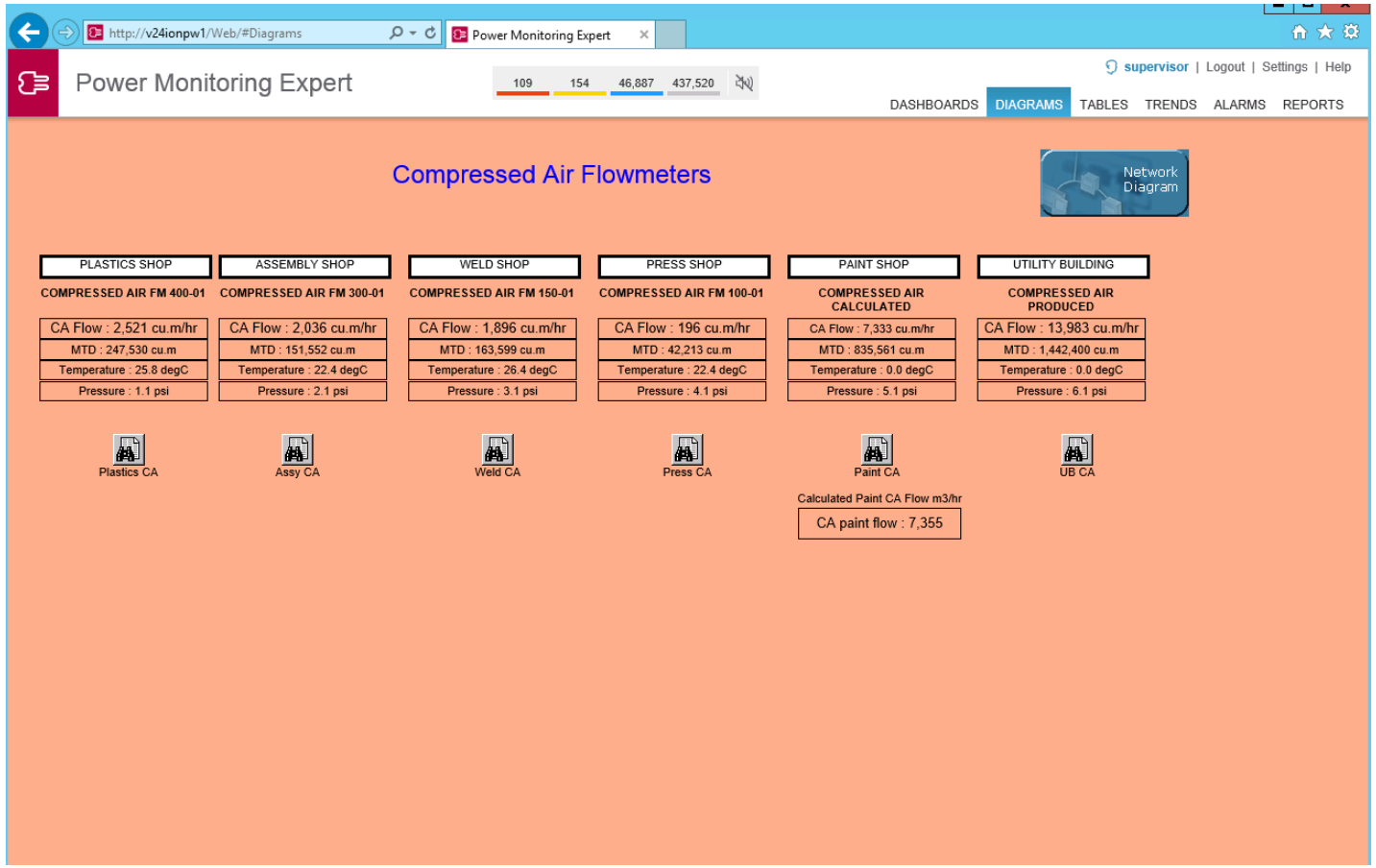
Woodstock Facility – Other Utilities

- Compressed Air Data in PME



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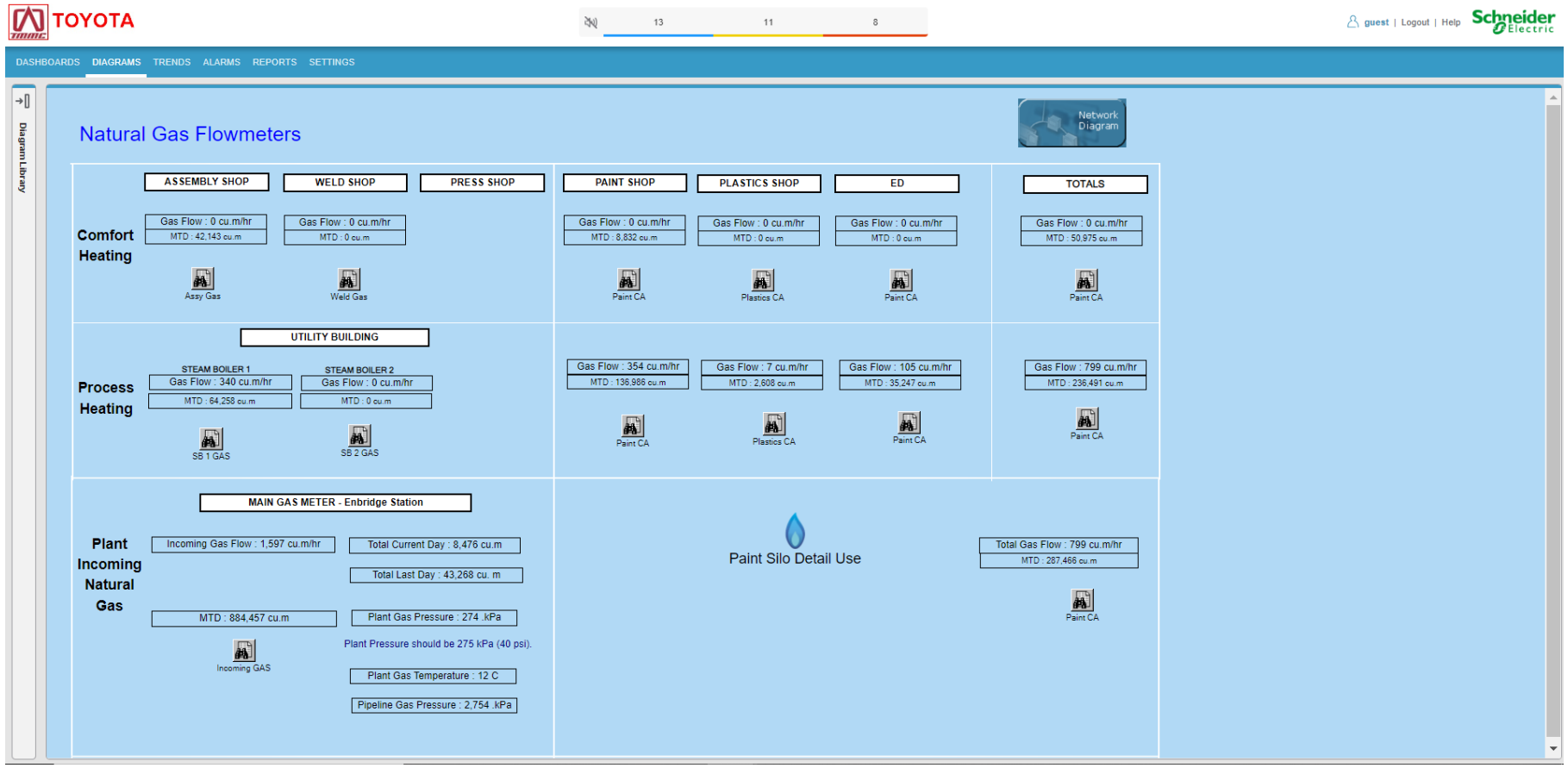
Woodstock Facility – Other Utilities

- Natural Gas Data in PME



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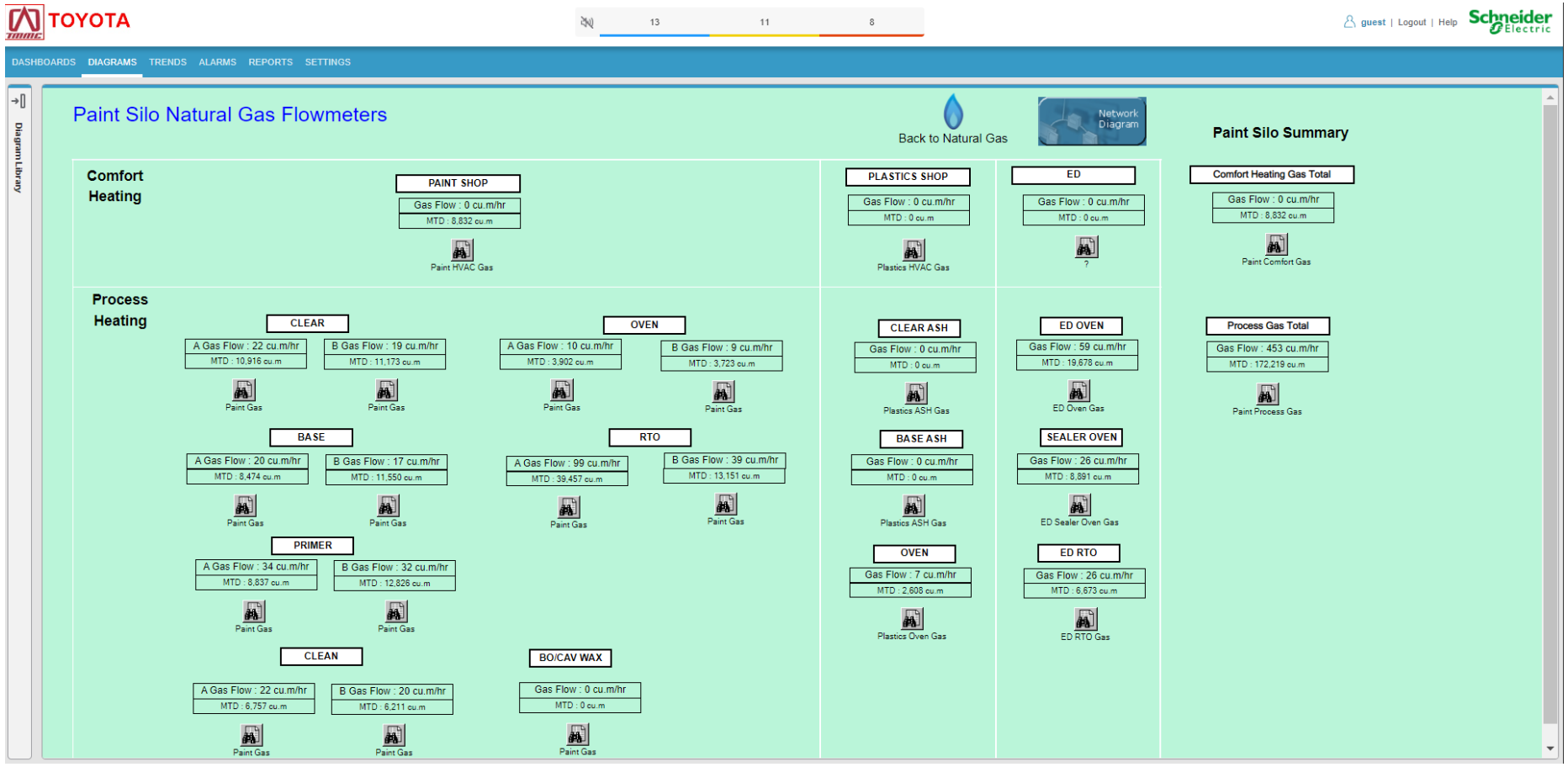
Woodstock Facility – Other Utilities

- Paint Silo Natural Gas Summary in PME



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Woodstock Facility – Next Steps

- Consolidate the Steam, Water, and Chilled Water Systems Utility Data into PME
- Integrate Cambridge Plant into PME
- Collect Data from our BMS to Calculate Chiller Efficiency in Real Time

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Cambridge Facility – Next Steps

- Migrate Eaton Power Meters into PME
- Current Eaton Meters Communicate via Modbus TCP
- Legacy INCOM Meters – Used Eaton's Power Xpert Gateway

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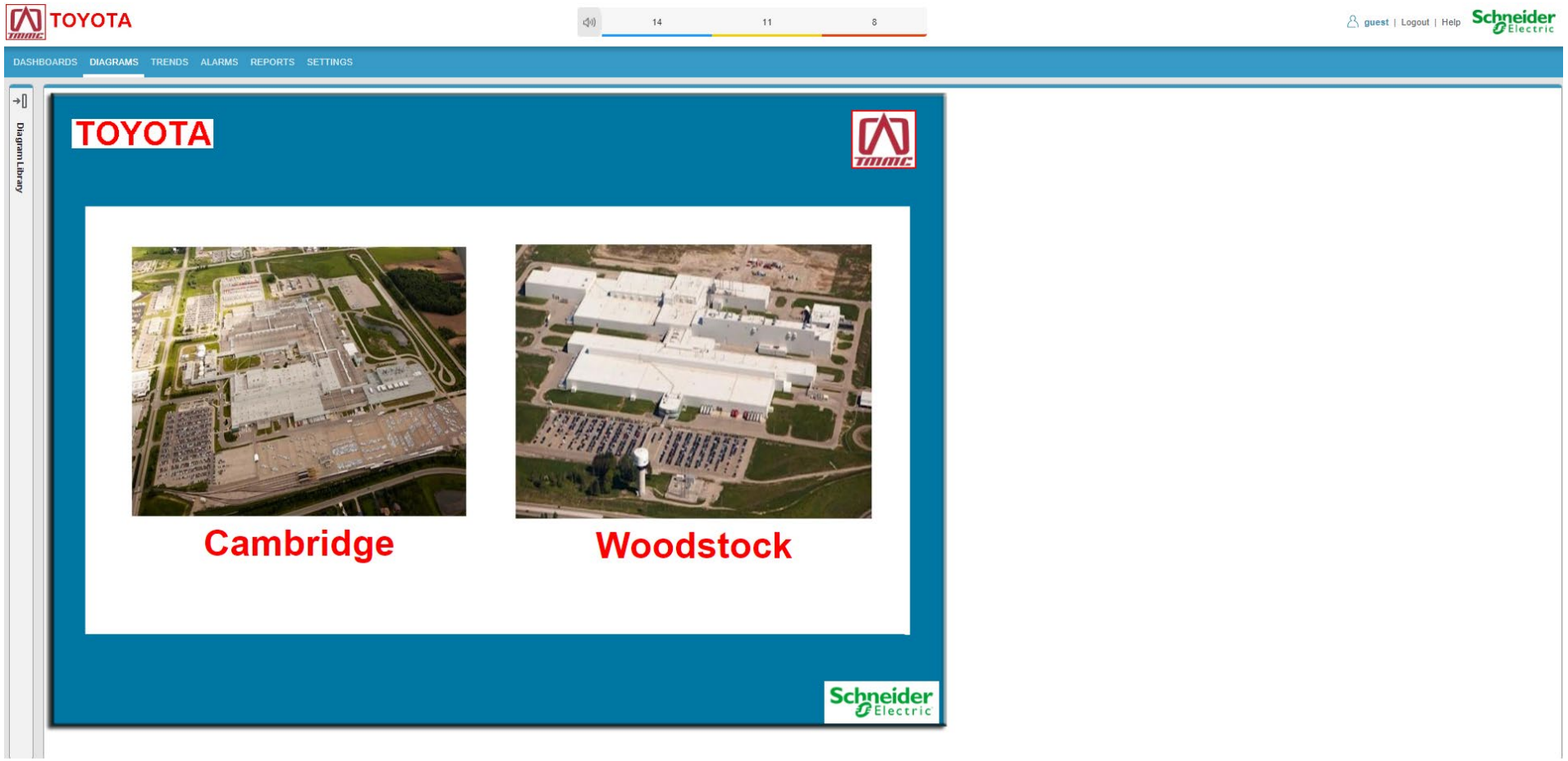
Cambridge Facility – Next Steps



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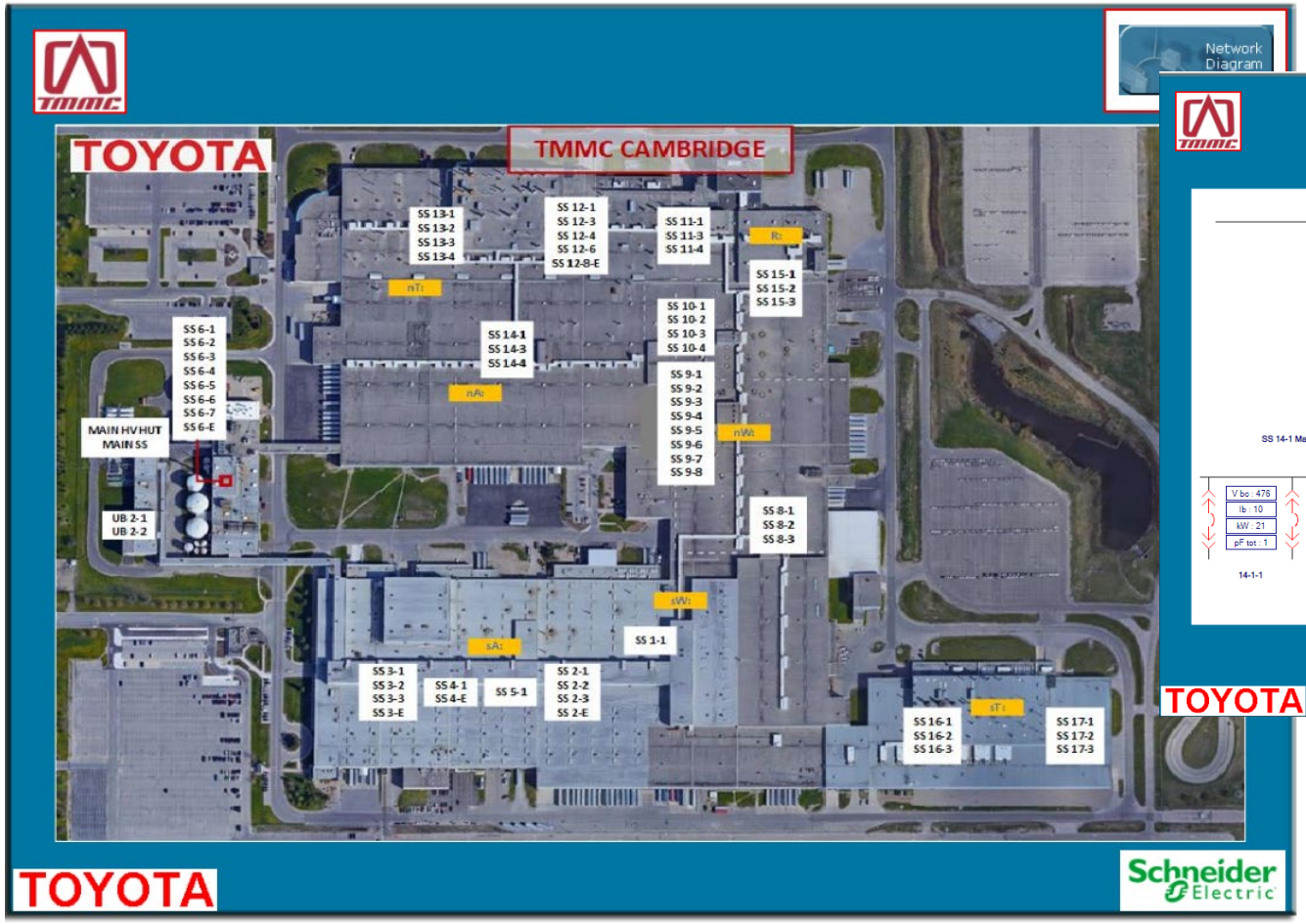
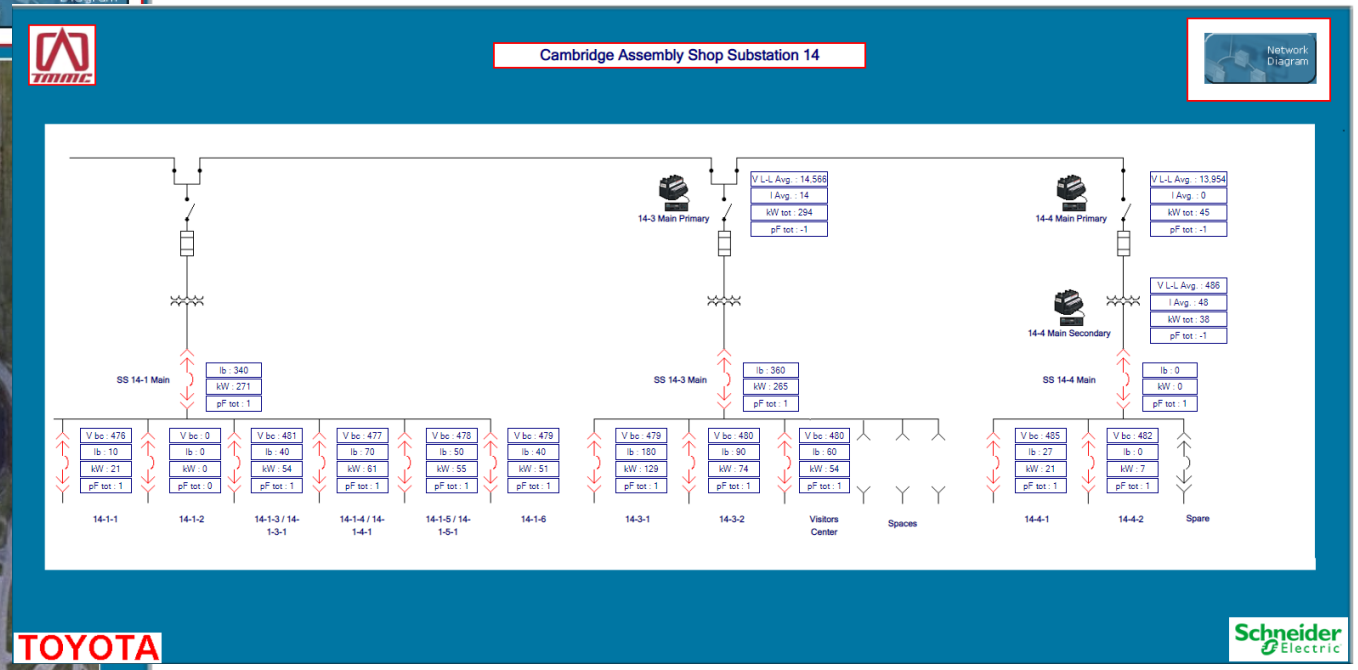
Cambridge Facility – Next Steps





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Woodstock Facility – Future Projects

- Gather Power Data From Our 2 Wireless LED Lighting Control Systems

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Woodstock Facility – Future Projects

Wireless LED Fixtures

Wireless Gateways

Energy Manager (BACnet)

BACnet – Modbus Gateway

To / From PME

LED Lighting

- Gather power data from each enlighted enabled LED fixture

- Peak Shaving mode capable

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Woodstock Facility – Kaizen Timeline

System	2016				2017				2018				2019				2020				2021				2022				2023			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Compressed Air Metering																																
Boiler Room Metering																																
NPE Challenge																																
Natural Gas Metering																																
Add Cambridge to PME																																

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Questions ?

2023 RAV4 Hybrid