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# **Electric ISR Long Range Plan Tech Session**

October 18, 2022

Business Use

# Objective

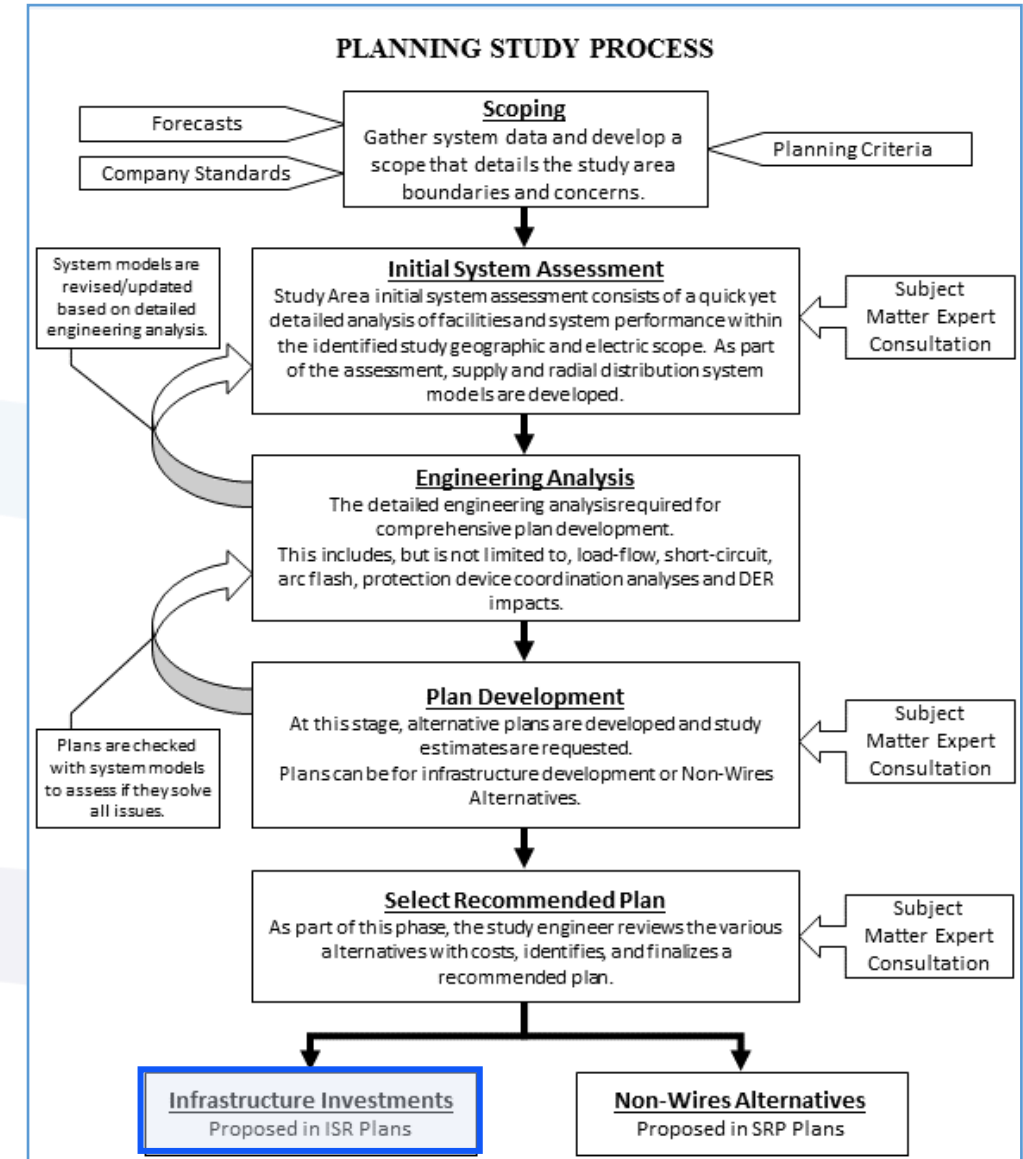
- Objective:
  - Discuss long range planning and the resulting capital investment plan
  - Describe how area planning is influenced by Grid Modernization (GMP)
- Approach:
  - Review Area Planning process
  - Present Major projects
  - Review GMP study approach, purpose and preliminary results
  - Discuss how GMP impacts Long Range Planning and investments
  - Provide examples where GMP impacted investment decisions
  - Present foundational GMP investments

# Refresh – Area Planning Study Process



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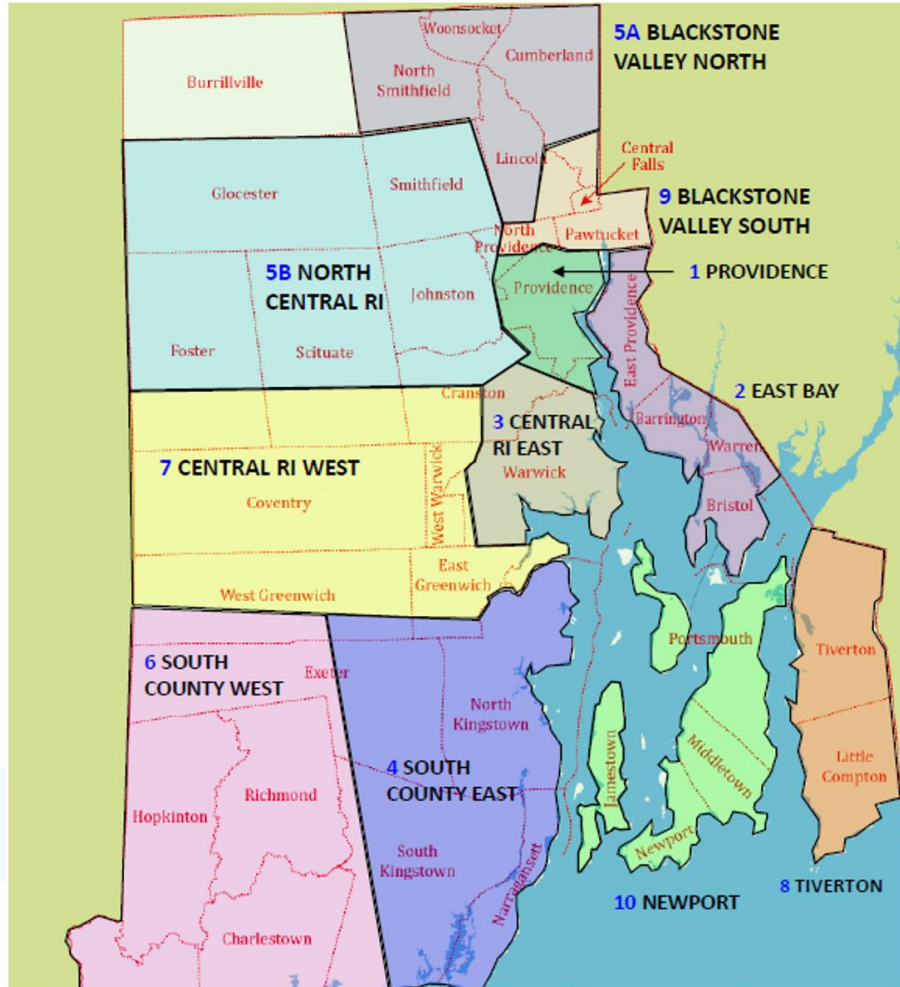
- **Stage 1:** Definition of electrical and geographical scope of study and gathering necessary data including planning criteria needed to execute the study.
- **Stage 2:** Initial system assessment consisting of a quick analysis of facilities and system performance within the identified study geographic and electric scope.
- **Stage 3:** Study kick off meeting held to inform the larger stakeholder group that an area planning study is underway and to solicit inputs from those with knowledge of the system infrastructure in the area under review.
- **Stage 4:** Detailed system assessment and engineering analysis.
- **Stage 5:** Development and project estimating of alternative infrastructure and non-wires alternative plans.
- **Stage 6:** Review of various alternatives' relative costs and benefits and identify and finalize a recommended plan.
- **Stage 7:** Technical review presentation with approval committee.
- **Stage 8:** Delivery of area planning study report documentation upon completion of the study.
- **Stage 9:** Sanction of any recommended projects having forecasted spending within the next three fiscal years.



# Area Planning Study Status



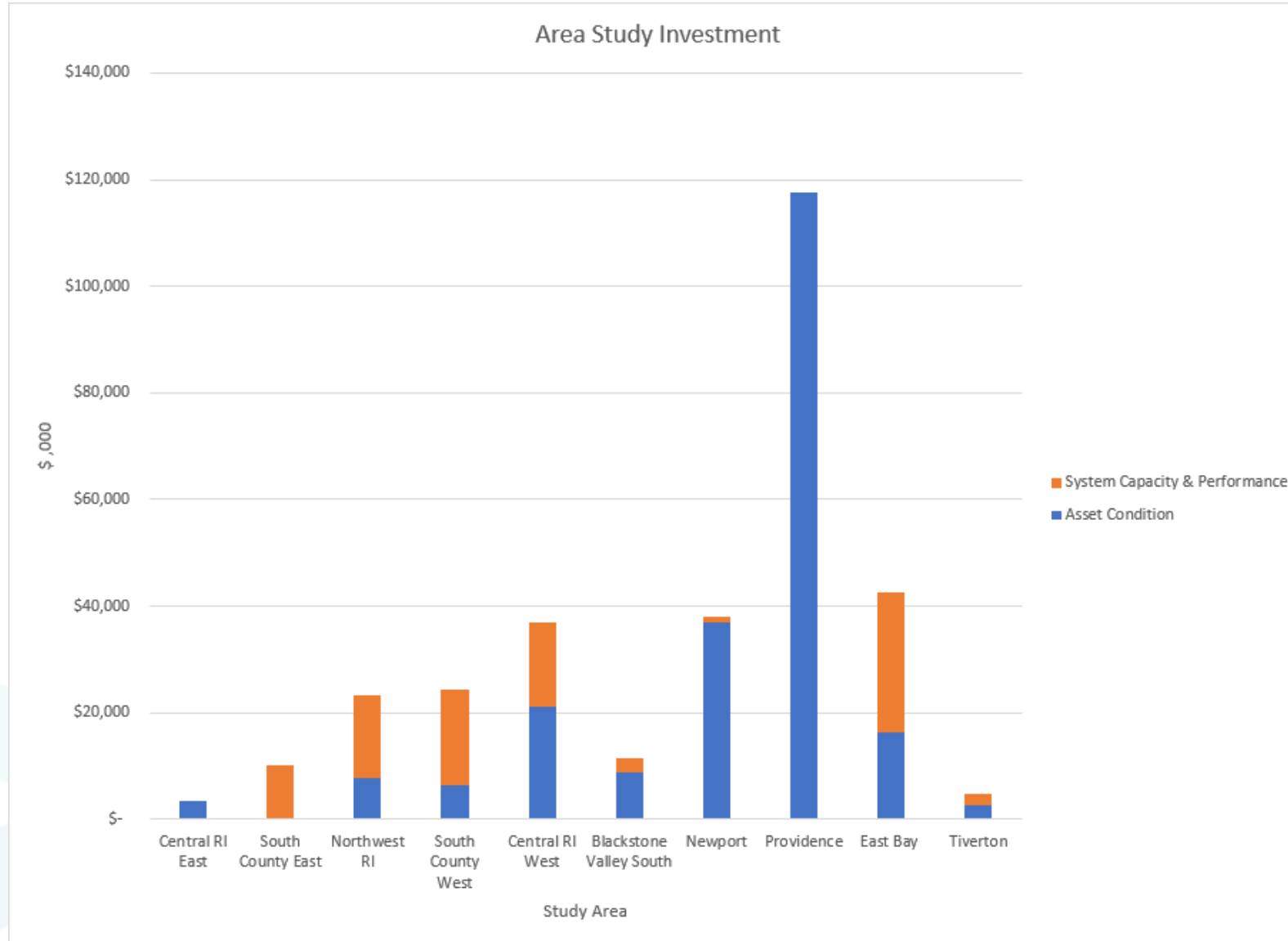
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| Study Area              | Load (MVA) | % State Load | # Feeders | # Stations | Annual Capacity Review % Complete | Area Planning Study % Complete | Study Completion Date |
|-------------------------|------------|--------------|-----------|------------|-----------------------------------|--------------------------------|-----------------------|
| Providence              | 358        | 19%          | 93        | 16         | 100%                              | 100%                           | May 2017              |
| East Bay                | 147        | 8%           | 22        | 7          | 100%                              | 100%                           | August 2015           |
| Central RI East         | 204        | 11%          | 37        | 9          | 100%                              | 100%                           | September 2017        |
| South County East       | 159        | 9%           | 22        | 10         | 100%                              | 100%                           | March 2018            |
| Blackstone Valley North | 139        | 8%           | 27        | 6          | 100%                              | 100%                           | March 2021            |
| North Central RI        | 269        | 15%          | 35        | 10         | 100%                              | 100%                           | March 2021            |
| South County West       | 98         | 5%           | 14        | 5          | 100%                              | 100%                           | October 2021          |
| Central RI West         | 167        | 9%           | 29        | 10         | 100%                              | 100%                           | May 2021              |
| Tiverton                | 36         | 2%           | 4         | 1          | 100%                              | 100%                           | May 2021              |
| Blackstone Valley South | 171        | 9%           | 54        | 8          | 100%                              | 100%                           | October 2021          |
| Newport                 | 105        | 6%           | 42        | 11         | 100%                              | 100%                           | December 2021         |
| Totals                  | 1,853      | 100%         | 379       | 93         | 100%                              | 100%                           |                       |

Annual Capacity Reviews are 100% complete for ALL Planning Areas

# Area Study Capital Investment by Area



# Major Project by Area – Asset Condition Active

| Study Area              | Major Project          | Description   |
|-------------------------|------------------------|---|
| Providence              | Dyer Street            | In the re-scoped Dyer Street Substation project, an external substation within the existing South Street Substation outdoor yard was built. The work involves the installation of two new 11 kV to 4.16 kV transformers and the corresponding risers and switches, the installation of a metal clad switch gear, and the needed distribution feeder getaways. The Company forecasts that the capital work on this project will be completed and assets will be in service by March 2023. The removal of the AC building will be completed during March 2023.  |
| Blackstone Valley North | Southeast/Dunnell Park | This project addressed asset condition and safety concerns at the Pawtucket No. 1 and the Dunnell Park substations as well as improvements to overall capacity. The Company forecasts that the capital work on this project will be completed and assets will be in service by March 2023.  |
| Providence              | Providence Phase 1 - 4 | The Providence Area Planning Study identified asset condition issues at five indoor substations and on over 25 miles of underground cable within the study area. The study recommended the expansion of the 12.47 kV distribution system to enable conversion of the majority of 11.5 kV and 4.16 kV load. This allows the elimination of several 4.16 kV and 11.5 kV indoor and outdoor stations and several miles of sub-transmission cable. A large part of the 12.47 kV capacity in the area would be provided by a new 115/12.47 kV station at Admiral Street. This substation will supply the converted load from the Geneva, Harris Avenue, Olneyville, and Rochambeau Avenue substations. |

# Major Project by Area – Asset Condition 21-month Pipeline

| Study Area      | Major Project           | Description  |
|-----------------|-------------------------|--|
| East Bay        | Phillipsdale Substation | The East Bay Area Study recommended replacing the Phillipsdale Substation and retiring of the Waterman Substation due to reliability issues and the age and condition of assets. Current planning recommends completing the project in two phases. The ultimate build-out will be a 115 / 12.47 KV substation and include two 40 MVA LTC transformers supplying straight-bus metal clad switchgear with a tie breaker, eight feeder positions, and two 7.2 MVAR two stage capacitor banks. In addition, [convert] the 23 kV sub-transmission system to 12.47 kV. |
| Northwest RI    | Centredale Substation   | The Northwest Rhode Island Area Study recommended rebuilding this substation and converting the 4 kV distribution loads to allow for retirement of the 4.16 kV equipment.  |
| Central RI East | Apponaug Substation     | The Central Rhode Island East Area Study recommended rebuilding this substation with two new 23/12.47 kV modular feeders utilizing standard open air modular feeder construction. Due to a history of operational challenges and asset condition issues, a short-term plan addressed the retirement of the 23 kV station, removal of equipment, and installation of relayed reclosers for transformer protection in previous years.  |
| Tiverton        | Tiverton Substation     | The Tiverton Area Study recommended the addition of a 12.47 kV breaker, three regulators, and a new getaway manhole and duct system inside the substation in addition to replacement of equipment with asset condition issues.   |

# Major Project by Area – System Capacity Active

| Study Area        | Major Project              | Description   |
|-------------------|----------------------------|---|
| Newport           | Aquidneck Island           | These projects included construction of a new 69 / 13.85 kV substation and related line work to provide load relief to the City of Newport; rebuilding the Jepson substation in Middletown; and the demolish and reconstruction of the Dexter Substation. This work is essentially complete and was placed into service during FY 2020 through FY 2022. The remaining work includes upgrades of various distribution circuits to improve reliability, the continued work on retiring substations, and minor improvements to certain substations.  |
| South County East | New Lafayette Substation   | A comprehensive study of the South County East area was performed to identify existing and potential future distribution system performance concerns. The study identified several reliability and asset condition issues. The study recommends building a new open air, low profile, breaker-and-one-half 115/12.47 kV substation at the existing Lafayette substation site. The existing 34.5/12.47 kV station at Lafayette will be retired once the new station is placed into service.  |
| East Bay          | Warren Substation          | The Warren #5 substation expansion project has been recommended as part of the East Bay Long Term Study. The project expands the existing substation by adding two new 12.47 kV feeders, a new substation capacitor, and new distribution construction to provide additional capacity to Warren and Barrington. In order to provide additional capacity to the Warren and Barrington area, distribution construction requires the crossing of the Barrington and Palmer Rivers in conjunction with on-going projects with RIDOT along the East Bay Bike Path. Completion of the project facilitates the retirement of the Barrington substation, which has safety and asset condition concerns, the capacity constrained Mink 115/23 kV substation, and a significant portion of the 23 kV sub-transmission in the area |
| East Bay          | East Providence Substation | The East Bay Long Term Study identified asset condition and loading concerns in the East Providence area. The study proposed a new station in the East Providence area that will reduce the loading and dependence on the 23 kV sub-transmission system. This project involves the construction of a new 115/12.47 kV substation adjacent to the 115 kV transmission right-of-way. The project requires a tap structure and easement within the public right of way to the 115kV transmission right-of-way. Construction will consist of a 40 MVA LTC transformer supplying straight-bus metal-clad switchgear with a tie breaker, six feeder positions, and two two-stage capacitor banks.   |

# Major Project by Area – System Capacity 21-month Pipeline

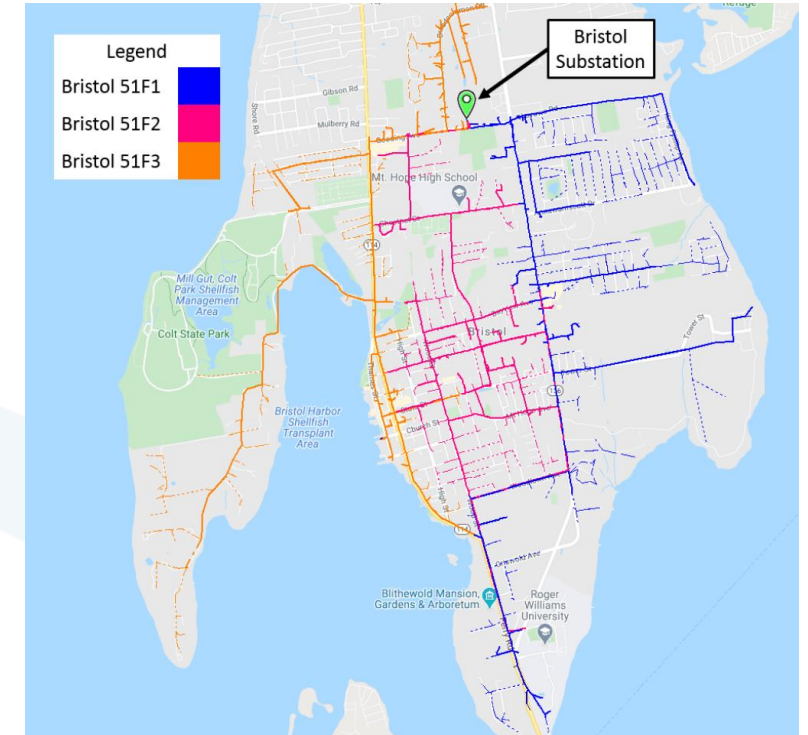
| Study Area      | Major Project | Description   |
|-----------------|---------------|---|
| Northwest RI    | Nasonville    | The Northwest Rhode Island Area Study recommended bringing a new 115 kV overhead supply line from Woonsocket substation to Nasonville substation and adding a second transformer and straight bus to the existing Nasonville substation. Due to the recent issues at this substation, the work plan will be reassessed. |
| Central RI East | Weaver Hill   | The Central Rhode Island East Area Study recommended installing a new substation on Weaver Hill Road due to overload concerns. This work will include extending the 3309 and 3310 lines for 1.7 miles, installing a transformer and one feeder position, and installing distribution line work for a new feeder.        |

# Alternative Analysis (NWA) - Example



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- Intends to address contingency load-at-risk issues on Bristol 51F1, 51F2, and 51F3.
- Load reduction need: 2.97 MW, 23.76 MWh
- Wires solutions: new feeder and existing feeder mainline upgrades
- NWA Approximate Value: \$1,590,000
- RFP period – June 2020- August 2020
  - Proposal included aggregated demand response (DR) using dispatchable diesel genset and energy storage system (ESS).
  - The bid was technically viable but did not meet the full need and was not cost-effective.
  - Bid considered carbon-heavy.



- NWA not pursued

| RFP Tracking Metric                                  | Bristol 51 |
|--|------------|
| Number of vendors invited to the NWA RFP             | 86         |
| Number of Vendors originally intended to participate | 23         |
| Number of vendor bids received                       | 1          |

# LRP Alignment – Area Studies / Programs Example

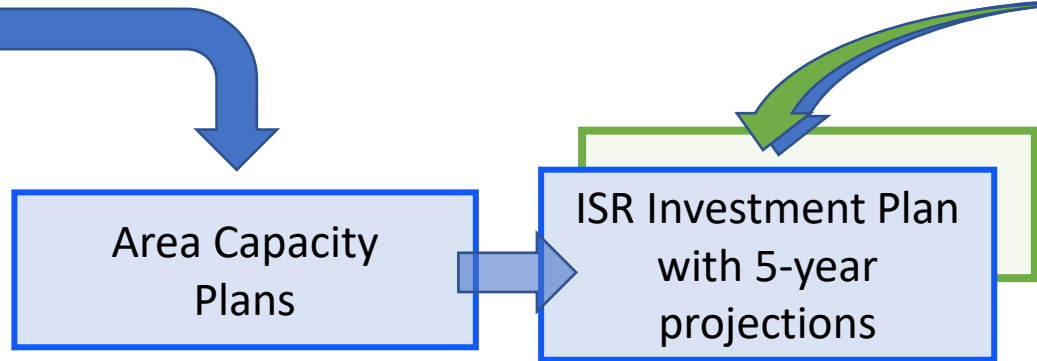
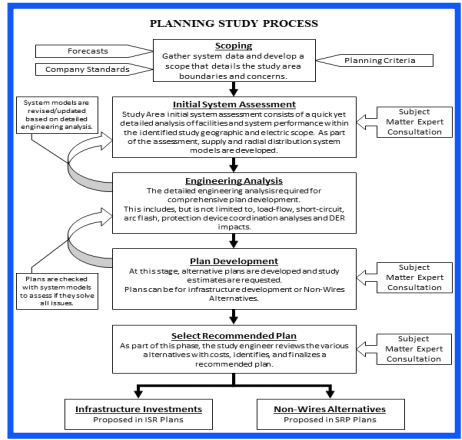
- Avoids duplication and early obsolescence
  - Example – Approximately 10 miles of underground cable eliminated from cable replacement program as a result of area study recommendations

| Feeder     | Updated Replacement Kft % Rank | Updated Replacement kFT | Probability | Criticality | Risk | Notes                    |
|------------|--------------------------------|-------------------------|-------------|-------------|------|--------------------------|
| 49_53_1103 | 0.977                          | 25.6                    | ● 5         | ● 5         | 25   |                          |
| 49_53_1171 | 0.899                          | 13.8                    | ● 5         | ● 5         | 25   |                          |
| 49_53_1101 | 0.949                          | 16.2                    | ● 5         | ● 4         | 20   |                          |
| 49_53_1144 | 0.834                          | 5.7                     | ● 5         | ● 4         | 20   |                          |
| 49_53_1169 | 0.77                           | 6.5                     | ● 4         | ● 4         | 16   |                          |
| 49_53_77J2 | 0.743                          | 11                      | ● 4         | ● 4         | 16   |                          |
| 49_53_77J4 | 0.788                          | 12.2                    | ● 4         | ● 4         | 16   |                          |
| 49_53_1113 | 0.926                          | 13.6                    | ● 5         | ● 3         | 15   |                          |
| 49_53_1114 | 0.871                          | 8.4                     | ● 5         | ● 3         | 15   | Eliminated in Prov Study |
| 49_53_1121 | 0.972                          | 20.9                    | ● 5         | ● 3         | 15   |                          |
| 49_53_1132 | 0.99                           | 19.8                    | ● 5         | ● 3         | 15   | Eliminated in Prov Study |
| 49_53_1135 | 0.889                          | 13.3                    | ● 5         | ● 3         | 15   |                          |
| 49_53_1137 | 0.88                           | 8.7                     | ● 5         | ● 3         | 15   | Eliminated in Prov Study |
| 49_53_1139 | 0.986                          | 20.6                    | ● 5         | ● 3         | 15   |                          |
| 49_53_1142 | 0.844                          | 5.7                     | ● 5         | ● 3         | 15   |                          |
| 49_53_1152 | 0.802                          | 15.1                    | ● 5         | ● 3         | 15   |                          |
| 49_53_1153 | 0.816                          | 14.8                    | ● 5         | ● 3         | 15   |                          |
| 49_53_12J5 | 0.862                          | 7                       | ● 5         | ● 3         | 15   | Eliminated in Prov Study |
| 49_53_2201 | 0.935                          | 12.5                    | ● 5         | ● 3         | 15   | Eliminated in Prov Study |
| 49_53_2J10 | 0.922                          | 14.8                    | ● 5         | ● 3         | 15   |                          |
| 49_53_2J7  | 0.802                          | 5.8                     | ● 5         | ● 3         | 15   |                          |

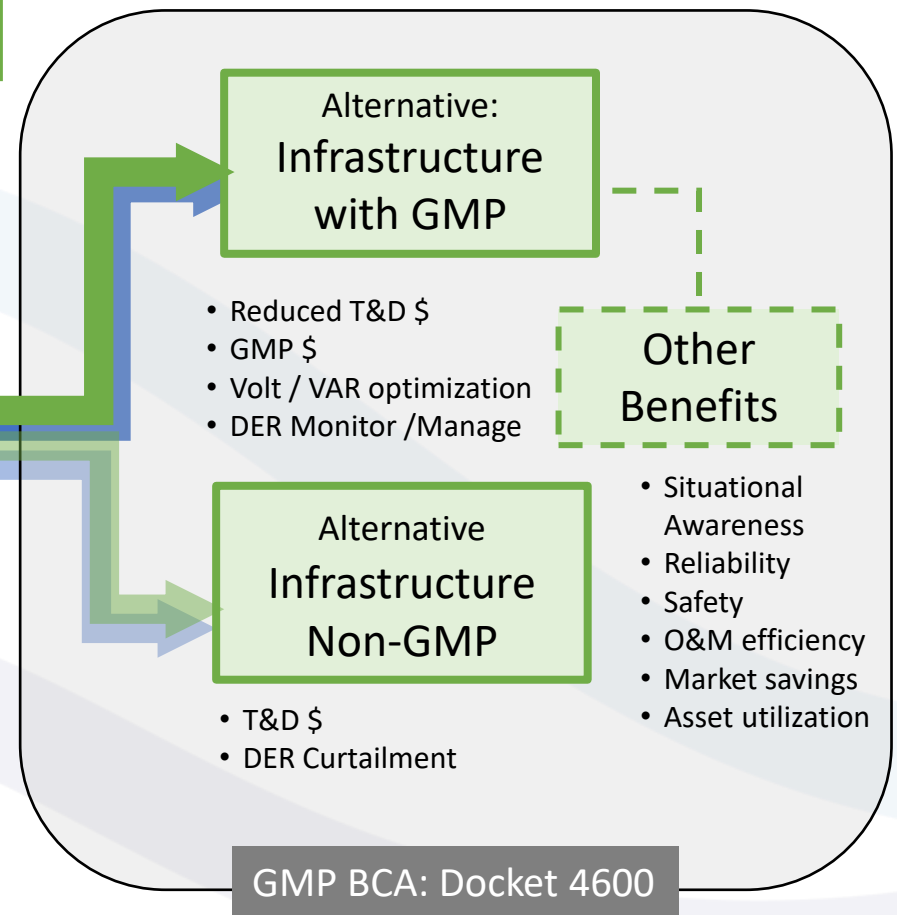
# Long Range Planning Process Considers GMP



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- DG Forecast
- EV Charging
- Energy Efficiency
- EHP Forecast



■ Traditional planning      ■ Planning with GMP

# Grid Modernization Study Scope

## Stakeholder Outreach and Consultation

### Scope

#### State-wide 8760 analysis

- 400 feeders
- Includes area study recommendations
- Sub-transmission modeling and testing
- System-wide transmission analysis

**Years:** 2030, 2040, 2050 – Aligned with Act on Climate

### Analysis

**Forecast:** Base, Low, High DER

#### Issue Identification:

- Determine load, voltage and protection issues
- Determine areas with degrading reliability
- Consider resiliency needs

#### Solutions:

- Non-Grid Modernization Solutions – Build for Extremes
  - Expand Distribution, Sub transmission and Transmission
- Grid Modernization Solutions – Manage away Extremes
  - Reduced Expansion of Distribution, Sub transmission and Transmission
  - System wide Automation & deployment of Sensing, Monitoring, Data Handling and Processing
  - DER Monitor Manage Energy Shift (TOU)
  - Battery Energy Storage Systems

### Estimation

#### Estimation:

- Equipment Costs
- Installation Costs

#### Road Map:

- Device Deployment Plan
- Functionality Availability

#### Leverage PPL experience

- Actual Costs
- Installation Assumptions
- Standards

### Benefit Cost Analysis

#### BCA:

- Comply with Docket 4600
- Update with PPL experience, Study and Reliability findings

#### Transition Component:

- ADMS 'Basic' came with the acquisition

#### Business Plan

# Grid Modernization DER Forecast – Impact to Peak

| GMP DER Forecast        |              |              |              |                     |              |              |
|-------------------------|--------------|--------------|--------------|---------------------|--------------|--------------|
|                         | 2030         |              | 2040         |                     | 2050         |              |
|                         | Summer       | Winter       | Summer       | Winter              | Summer       | Winter       |
| Heat Pumps (MW)         | 0            | 200          | 5            | 1310                | 5            | 2825         |
| Heat Pumps (Ea.)        | 54,000       | 54,000       | 325,000      | 325,000             | 400,000      | 400,000      |
| Solar PV Nameplate (MW) | 1,500        | 1,500        | 3,400        | 3,400               | 5,000        | 5,000        |
| Electric Vehicles (MW)  | 70           | 80           | 805          | 910                 | 1010         | 238          |
| Electric Vehicles (Ea.) | 87,300       | 87,300       | 675,000      | 675,000             | 840,000      | 840,000      |
| RIE Peak Demand (MW)    | <b>1,940</b> | <b>1,415</b> | <b>2,519</b> | <b><u>3,280</u></b> | <b>2,785</b> | <b>3,855</b> |

More  
Distributed  
Generation  
than Load

Winter Peak

Peak Demand Doubles

# Grid Modernization Model Inputs

- Base Model – as used with typical planning studies
  - **Area study recommendations**
  - Existing distributed generation confirmed
- Forecasted load, generation, electric vehicles, heating (heat pumps) added
  - Load forecast with energy efficiency incorporated into load profiles
  - Generation added to the model explicitly
    - General distribution PVs added as 100kW sites
    - Specific PV and Wind sites added to sub-transmission
    - Generation load cycles are based on PVWatts and actual data
  - Electric vehicles and heat pumps added as customer load types to existing load sites
    - Electric vehicle load cycle based on EVI-Pro-Lite
    - Heating pump load based on industry research and 2015 weather year

# Grid Modernization Tiverton Preliminary Area Results 2040

Loading

2/13/2040 6PM

4/16/2040 11AM

Voltage

2/13/2040 6PM

4/16/2040 11AM

Cool colors are shaded and have no issues



Warm colors are issues

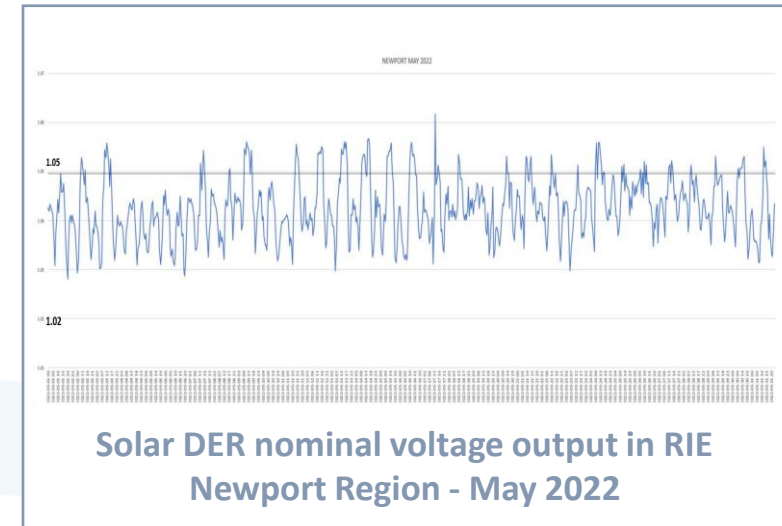


# RIE Operational Characteristics Now



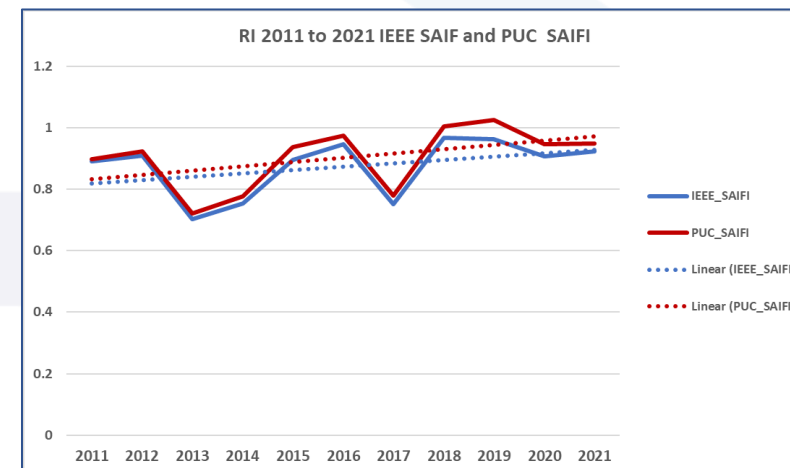
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- Operational Characteristics:
  - Growing DER adoption and interconnection queue
  - Increased variability of load, voltage, and power flow which increases system complexity
  - Greater operational uncertainty
  - Greater dependency on local generation to balance with load
  - Lacking real time situational awareness
- Consequence:
  - Increasing reliability and safety risk (see trend)
  - DER curtailment and interconnection delays
  - Challenges to recover from major events
  - Recent example at Nasonville



*\*Voltage repeatedly exceeds 1.05 per unit operating target*

*\*Required to maintain  $\pm 5\%$  of nominal voltage ie 0.95 to 1.05 per unit voltage.*



*SAIFI trending worse (up) in recent years*

# Grid Modernization Tiverton Preliminary Area Solutions

## ➤ Non-Grid Mod Solutions

- 3 new feeders added to existing Tiverton Substation
- New area Substation with 2 new feeders added

## ➤ Grid Mod Solutions

- 2 new feeders to existing Tiverton Substation
- 4 BESS Sites - Generation shifts
- Load shifts

- Non-Grid Mod solutions will inform deferred capital investment of the Grid Mod Plan
  - Savings in an order of 30-50%



# How are Area Study Investments Impacted – Example #1

- Reinforces Tiverton Area Study Recommendation:
  - Extend a new 33F6 circuit to Brayton Road
  - Use 33F6 to pick up load from other circuits
  - Reconductor ~ 1 mile of conductor and install 33F6/33F4 Feeder Tie

| Project                                   | FY23* | FY24   | FY25   | FY26   | FY27   | FY28   | FY29  | Total    |
|---|-------|--------|--------|--------|--------|--------|-------|----------|
| Tiverton Sub (D-Line)                     | \$ 64 | \$ 291 | \$ 574 | \$ 656 | \$ 410 | \$ 164 | \$ 27 | \$ 2,187 |
| Tiverton Sub (D-Sub)                      | \$ 85 | \$ 341 | \$ 687 | \$ 786 | \$ 491 | \$ 196 | \$ 33 | \$ 2,619 |
| *FY23 9 month spend April 1 – December 31 |       |        |        |        |        |        |       |          |

\*FY23 - 9 Months April 1 - December 31, 2023  
\$ ,000

- Refer to Grid mod plan to inform Engineering and Design
- May see modest increases to proposed area study recommendation spend to accommodate future infrastructure needed for DER enablement
  - Full substation bay build out
  - Extra duct banks in manhole & duct system
  - Line work to consider clearances for additional OH Circuits



## How are Area Study Investments Impacted – Example #2

- Reconsider Newport Area Study Merton Substation Recommendation:
  - Rebuild existing 4kV Merton Substation due to asset condition issues

| Project                                   | FY23* | FY24   | FY25     | FY26     | FY27     | FY28     | FY29   | Total    |
|---|-------|--------|----------|----------|----------|----------|--------|----------|
| Merton #51 Equipment Replacement (D-Sub)  | \$ -  | \$ 919 | \$ 1,531 | \$ 1,939 | \$ 2,041 | \$ 1,429 | \$ 306 | \$ 8,164 |
| *FY23 9 month spend April 1 – December 31 |       |        |          |          |          |          |        |          |

\*FY23 - 9 Months April 1 - December 31, 2023  
\$,000

- Grid Mod Recommendation:
  - Convert Substation and Distribution Line to 12kV
- Engineering Scheduled Start FY24
  - FY25 – FY29 estimates will be revised appropriately

# Key Takeaways

- System must be setup with proper sensing and data handling and processing. The need is now!
- Combined Grid Modernization devices provide comprehensive situational awareness and control required – e.g. FLISR, VVO, DER Monitor/Manage, Advanced Reclosers, Smart Capacitors and Regulators, Relay Upgrades
- The greatest Grid Modernization benefits are achieved when linked to an AMF deployment
- Grid Modernization study used a dispersed DER allocation to test system limits and identify solutions required to meet Act on Climate and clean energy policies
  - Grid Modernization technology provides the operational capabilities needed and is a more economical alternative. System requirements are being factored into Long Range Planning
  - Actual interconnections can cause localized issues in the immediate future
  - Future infrastructure investments will be informed by customer DER adoption
- The ADMS Platform is being provided to RIE at no cost and enables a wide range of immediate benefits
- Deployment will take time: many other utilities are addressing the same issues. Supply chain issues, system issues, operational needs dictate that RIE deploy GMP on an accelerated basis.

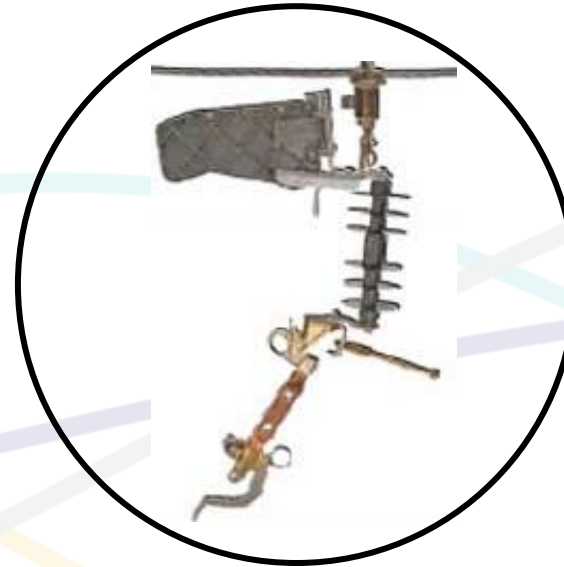
# The Present - Mechanical Devices



Protective:  
Oil-Circuit Recloser



Sectionalizing:  
Air-Break Switch



Sectionalizing:  
Load-Break Switch



Sectionalizing:  
Fused Cutout

# The Proposed – Grid Modernization Components



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Protective & Sectionalizing:  
Vacuum Circuit Recloser



Switchable Capacitor  
Controller



Voltage Regulator  
Controller



Recloser Control  
with Downed  
Conductor  
Detection



Cellular and Fiber  
Communications



System Operations:  
FLISR and VVO enabled

- Provides operational flexibility, remote settings and operation, ADMS telemetry, forward/reverse fault detection
- Collectively provides comprehensive situational awareness and increased system control
- The greatest benefits when linked to an AMF

# Grid Modernization Capital Investment by Technology

| Program                          | FY23 |        | FY24 | FY25   |    | FY26   | FY27 |        | FY28 | Total  |    |        |    |         |
|----------------------------------|------|--------|------|--------|----|--------|------|--------|------|--------|----|--------|----|---------|
| ADMS/DERMS Advanced              | \$   | 105    | \$   | 140    | \$ | 3,160  | \$   | 1,569  | \$   | 4,387  | \$ | 2,168  | \$ | 11,529  |
| Advanced Capacitors & Regulators | \$   | 4,629  | \$   | 6,171  | \$ | 6,210  | \$   | 6,300  | \$   | 6,480  | \$ | 1,800  | \$ | 31,590  |
| Advanced Reclosers               | \$   | 17,405 | \$   | 25,190 | \$ | 25,694 | \$   | 26,208 | \$   | 26,732 | \$ | 27,266 | \$ | 148,494 |
| DER Monitor/Manage               | \$   | 651    | \$   | 831    | \$ | 1,017  | \$   | 1,210  | \$   | 1,322  | \$ | 1,437  | \$ | 6,469   |
| Electromechanical Relay Repl Pgm | \$   | 2,040  | \$   | 2,789  | \$ | 4,829  | \$   | 8,145  | \$   | 6,461  | \$ | 6,355  | \$ | 30,618  |
| Fiber Network                    | \$   | 8,105  | \$   | 11,348 | \$ | 17,875 | \$   | 15,278 | \$   | 7,997  | \$ | 7,997  | \$ | 68,600  |
| IT Infrastructure                | \$   | 1,514  | \$   | 2,019  | \$ | 2,999  | \$   | 4,282  | \$   | 4,837  | \$ | 757    | \$ | 16,408  |
| Mobile Dispatch                  | \$   | 74     | \$   | 98     | \$ | 172    | \$   | 196    | \$   | 196    | \$ | 49     | \$ | 784     |
| Total                            | \$   | 34,522 | \$   | 48,586 | \$ | 61,955 | \$   | 63,187 | \$   | 58,413 | \$ | 47,829 | \$ | 314,492 |

\*FY23 - 9 Months April 1 - December 31, 2023

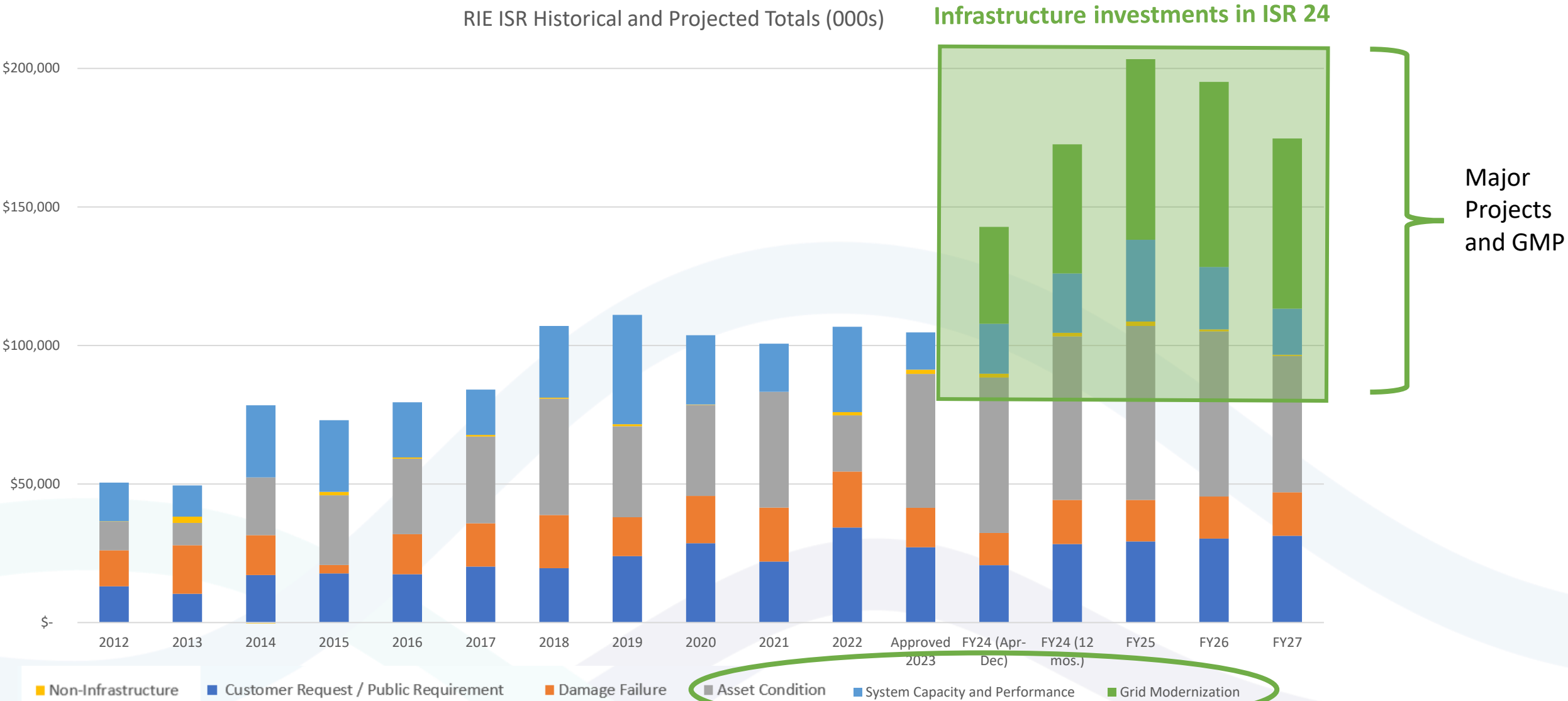
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# Long Range Plan – Area Studies & Grid Mod

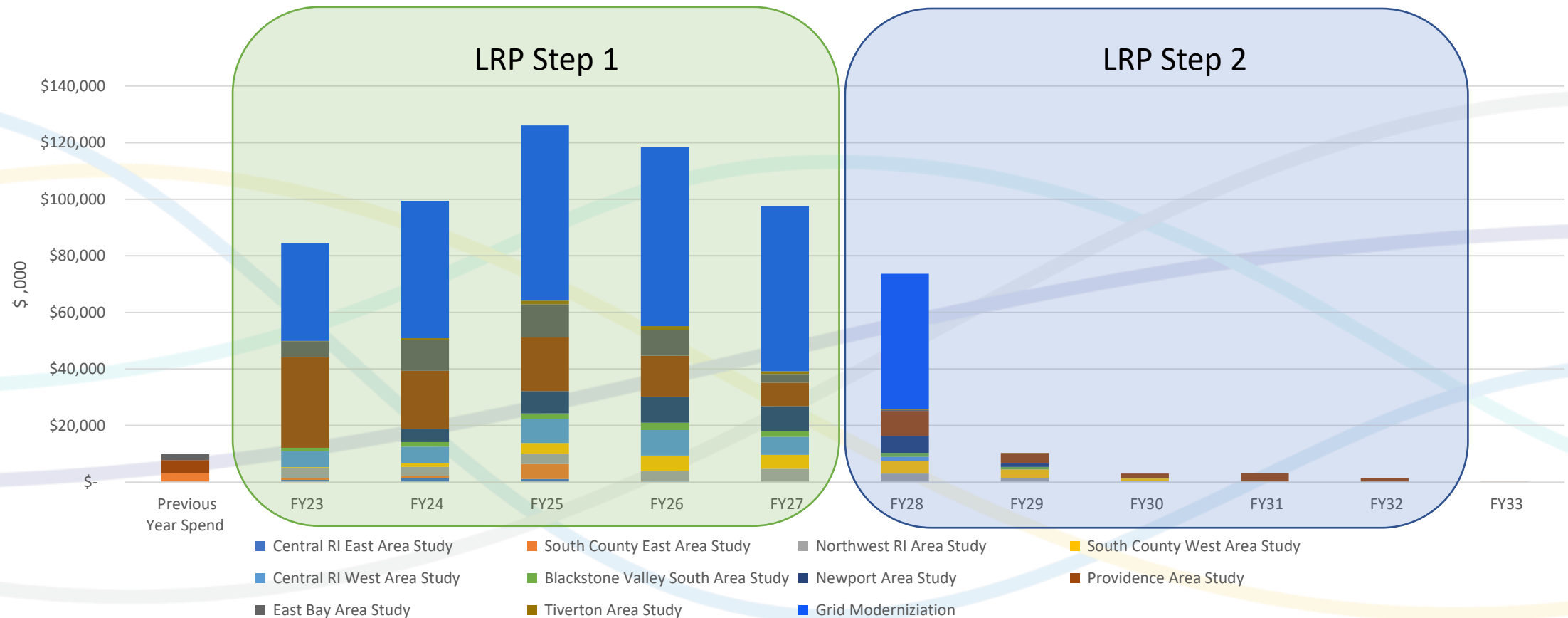
| Program   | Previous Year Spend | FY23      | FY24      | FY25       | FY26       | FY27      | FY28      | FY29      | FY30     | FY31     | FY32     | FY33   | Sum of Total |
|---|---------------------|-----------|-----------|------------|------------|-----------|-----------|-----------|----------|----------|----------|--------|--------------|
| Central RI East Area Study                              | \$ -                | \$ 763    | \$ 1,428  | \$ 1,096   | \$ 255     | \$ 16     |           | \$ -      | \$ -     | \$ -     | \$ -     | \$ -   | \$ 3,558     |
| South County East Area Study                            | \$ 3,236            | \$ 750    | \$ 750    | \$ 5,344   | \$ 151     | \$ -      | \$ -      | \$ -      | \$ -     | \$ -     | \$ -     | \$ -   | \$ 10,231    |
| Northwest RI Area Study                                 | \$ -                | \$ 3,524  | \$ 3,192  | \$ 3,696   | \$ 3,415   | \$ 4,669  | \$ 3,040  | \$ 1,463  | \$ 293   | \$ -     | \$ -     | \$ -   | \$ 23,290    |
| South County West Area Study                            | \$ -                | \$ 236    | \$ 1,388  | \$ 3,686   | \$ 5,529   | \$ 4,939  | \$ 4,490  | \$ 3,014  | \$ 992   | \$ 119   | \$ -     | \$ -   | \$ 24,392    |
| Central RI West Area Study                              | \$ -                | \$ 5,725  | \$ 5,799  | \$ 8,635   | \$ 9,089   | \$ 6,362  | \$ 1,363  | \$ -      | \$ -     | \$ -     | \$ -     | \$ -   | \$ 36,973    |
| Blackstone Valley South Area Study                      | \$ -                | \$ 1,128  | \$ 1,552  | \$ 1,816   | \$ 2,554   | \$ 2,020  | \$ 1,426  | \$ 905    | \$ 193   | \$ -     | \$ -     | \$ -   | \$ 11,593    |
| Newport Area Study                                      | \$ -                | \$ -      | \$ 4,708  | \$ 7,905   | \$ 9,216   | \$ 8,846  | \$ 6,046  | \$ 1,296  | \$ -     | \$ -     | \$ -     | \$ -   | \$ 38,017    |
| Providence Area Study                                   | \$ 4,530            | \$ 32,067 | \$ 20,566 | \$ 19,130  | \$ 14,477  | \$ 8,287  | \$ 8,788  | \$ 3,580  | \$ 1,529 | \$ 3,183 | \$ 1,325 | \$ 130 | \$ 117,591   |
| East Bay Area Study                                     | \$ 2,084            | \$ 5,592  | \$ 10,839 | \$ 11,555  | \$ 9,046   | \$ 3,116  | \$ 323    | \$ -      | \$ -     | \$ -     | \$ -     | \$ -   | \$ 42,553    |
| Tiverton Area Study                                     | \$ -                | \$ 149    | \$ 632    | \$ 1,262   | \$ 1,442   | \$ 901    | \$ 360    | \$ 60     | \$ -     | \$ -     | \$ -     | \$ -   | \$ 4,806     |
| Grid Modernization                                      | \$ -                | \$ 34,522 | \$ 48,586 | \$ 61,955  | \$ 63,187  | \$ 58,413 | \$ 47,829 |           |          |          |          | \$ -   | \$ 314,492   |
| Grand Total   | \$ 9,850            | \$ 84,455 | \$ 99,439 | \$ 126,079 | \$ 118,360 | \$ 97,569 | \$ 73,665 | \$ 10,317 | \$ 3,006 | \$ 3,302 | \$ 1,325 | \$ 130 | \$ 627,497   |
| *FY23 - 9 Months April 1 - December 31, 2023<br>\$ ,000 |                     |           |           |            |            |           |           |           |          |          |          |        |              |

- Project schedules and cash flows were developed based on the need identified during the area study, required sequencing of the work, and resource needs.
  - Prioritization is informed by study factors
  - Projects with specific driver are not prioritized or ranked against other projects with the same driver. Example – one oil leak is not compared against another oil leak
  - Severity of the physical, mechanical, or electrical condition cannot be compared to develop a prioritization
  - While affordability is a concern, benefits outweigh the costs and can affect long term affordability

# Long Range Planning Investment Scope Includes GMP



# Long Range Plan – Area Studies & Grid Mod



- Future area infrastructure investments expected to be introduced in Long Range Plan after FY26
- Informed by actual customer DER adoption

# Appendix



# Grid Modernization: Why? Why NOW??

- Grid was originally **designed for one-way power flow**, provides little distribution operator visibility and limited automation
- **Accelerated grid transformation needed** for 21<sup>st</sup> century to manage increased complexity. Caused by increased DER penetration and electrification reinforced by State clean energy policy
- Successful operations requires comprehensive **situational awareness** and more **system control**
- Capability provided by **AMF and GMP**
- The **time is NOW**: Reliability trends, Nasonville lessons, renewable interconnection queue, hidden load from switching, high-end DER forecast adoption, clean energy mandates, ADMS availability, increased GMP capability from PPL experience
- **Impacts of a delay**: opportunity cost, customer service, safety, reliability, increased costs, affordability risks, supply chain, delayed benefits, ability to enable clean energy
- **Included in FY24 ISR**: accelerating GMP investments