Distribution Planning Criteria

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Today’s Speakers

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Overview

Planning Process
- Cyclical process focuses on assuring adequate electric capacity
- Planning for emergency or maintenance needs contributes to reliability and safety

Planning Objectives
- Overarching operational objectives are embedded within the planning process and translate into criteria

Planning Criteria
- Planning criteria translates objectives into quantitative thresholds and conditions

Distribution Budget
- Capital budget illustrates result of capacity and asset planning processes
- Some distribution spending is unrelated to planning criteria
Distribution Planning Process

- **Cyclical Annual Process**
  - Incremental needs

- **Asset Management**

- **Design and Construction**
  - Distribution Projects: 1-2 years
  - Substation projects: 3-5 years

Steps Affected by Planning Criteria
Distribution Planning Objectives

Safety
Reliability
Cost
State Policy

Average U.S. customer hours interrupted (SAIDI)
total duration (hours)

Source: EIA
https://www.eia.gov/todayinenergy/detail.php?id=37652
Translating Objectives into Criteria

Objectives: Goals for desirable system characteristics or attributes

Criteria: Principles or standards by which system risks or solutions may be evaluated or prioritized

Planning Criteria
Distribution Planning Criteria

- Electric Capacity
  - Normal
  - Contingency
- Voltage
- Reliability

Illustration of Voltage Criteria

Planning for Electric Capacity

Normal Operations

“Radial” System

Transformer 1

- Feeder A
- Feeder B

Transformer 2

- Feeder C
- Feeder D

Residential (~500 – 1,500 customers)

Commercial and Industrial

DER is analyzed for system normal configuration

Credit: Ameren
https://www2.ameren.com/common/DistributionSystem.aspx
Planning for Capacity
System Flexibility

Feeders broken into three sections by switches

Each section carries 25% of feeder capacity

Feeder is loaded to 75% of capacity at full loading to be capable of carrying section of adjacent feeder

Credit: Ameren
https://www2.ameren.com/common/DistributionSystem.aspx
Planning for Capacity
Contingency Operations

Blue Substation
Transformer 1
Feeder A
Feeder B
Transformer 2
Feeder C
Feeder D

Feeder A
Section 1
Section 2
Section 3

Red Substation
Transformer 1
Feeder W
Feeder X
Feeder Y
Feeder Z
Transformer 2

Feeders would be also be segmented into three sections like Feeder A

DER may not be studied for abnormal or contingency configurations
Contingency Capacity Criteria

Example: Substation Transformer Outage

Substation is operating under single contingency or “N-1”
Feeders picking up sections are now fully loaded

Each feeder was previously at 75% and a 25% section of Feeder A was added
State policy goals driving changes to distribution planning criteria

- Regulatory Drivers
  - More Data and Better Tools
    - More DER
      - Solar PV, wind, energy storage, energy efficiency, demand response
  - Aging Infrastructure
  - Energy Conservation
  - Safety, Resilience and Reliability
  - Need for Greater Grid Flexibility
  - Non-Wire Alternatives
Evolving Objectives and Criteria

Traditional Planning Considerations

**Objectives:**
- Safety
- Reliability
- Cost
- Policy

**Criteria:**
- Electric Capacity
- Voltage
- Reliability

Emerging Needs

- System Efficiency
- DER Integration
- Resilience
- Security
- Flexibility

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**Capacity Planning**

Process to plan for adequate system capacity under normal and contingency operations

- **Capacity Planning** is typically an annual process to address load growth or movement of load around the system
- System analyzed for normal and contingency conditions
- Solutions identified and proposed to address constraints

**Asset Health**

Programs to plan the replacement of aging assets

- **Asset health** programs contribute to system reliability and the customer experience
- Different approaches to asset health
  - Corrective Maintenance – replacing failed assets
  - Preventative Maintenance – replacing assets prior to failure
  - Reliability-Centered Maintenance – replace assets based on historic reliability records
  - Condition-based Predictive Maintenance – proactive and situational based
Distribution Budget

Two Main Components:
• Capacity Planning
• Asset Health
Distribution Budget for Capacity

- Traditional Planning Criteria Targets *Electric Capacity* which drives Capital Investment

- Spending Indirectly Affected by Planning Criteria
  - Asset Health
  - Reliability

- Some Budget Aspects Not Related to Criteria

ILLUSTRATIVE DISTRIBUTION BUDGET

- Cost

- Fleet and Equipment
- New Service
- Reliability
- Mandates
- Other
- Asset Health
- Electric Capacity

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Distribution Planning is a key component of the utility budget and many aspects are influenced by discretionary and non-discretionary investments and costs. These are evident through both Capital and Operations & Maintenance budgets.

- Emergency, 18%
- Replacement, 22%
- Risk Reduction, 18%
- Municipal Works (Interference), 5%
- Resiliency, 7%
- System Expansion, 9%
- New Business, 13%
- Information Technology, 3%
- Grid Technology, 5%
- Cost
Utility Investments - O&M

- Elements of discretionary and non-discretionary investments and costs
- Much of the required programs in support of these categories are often mandates in rate cases, driven by the need to maintain safety, reliability, and resilience.
Cost-Effectiveness

- Utilities have presented various methods to document the cost effectiveness of their proposed investments in Rate Case submittals
- The U.S. DOE-DSPx Decision Guide (Volume III) outlines cost-effectiveness methods and their application by category of grid expenditure
- There are three (3) main types of methodologies used to evaluate grid expenditures

<table>
<thead>
<tr>
<th>Methodology</th>
<th>Grid Expenditure Category</th>
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<td>Least-cost, best-fit</td>
<td>• Investments required to meet specifications and standards to maintain safety and reliability</td>
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| Benefit Cost Analysis        | • Investments for energy efficiency or demand side management (DSM) programs, non-wires solutions, and/or DG tariffs  
  • Other expenditures proposed to enable public policy or incremental societal benefits |
| Opt-in (no regulatory justification) | • Investments deliberately paid by customers to integrate their distributed resource |
Q&A – 15 min
Thank you!

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