Distribution Planning Process

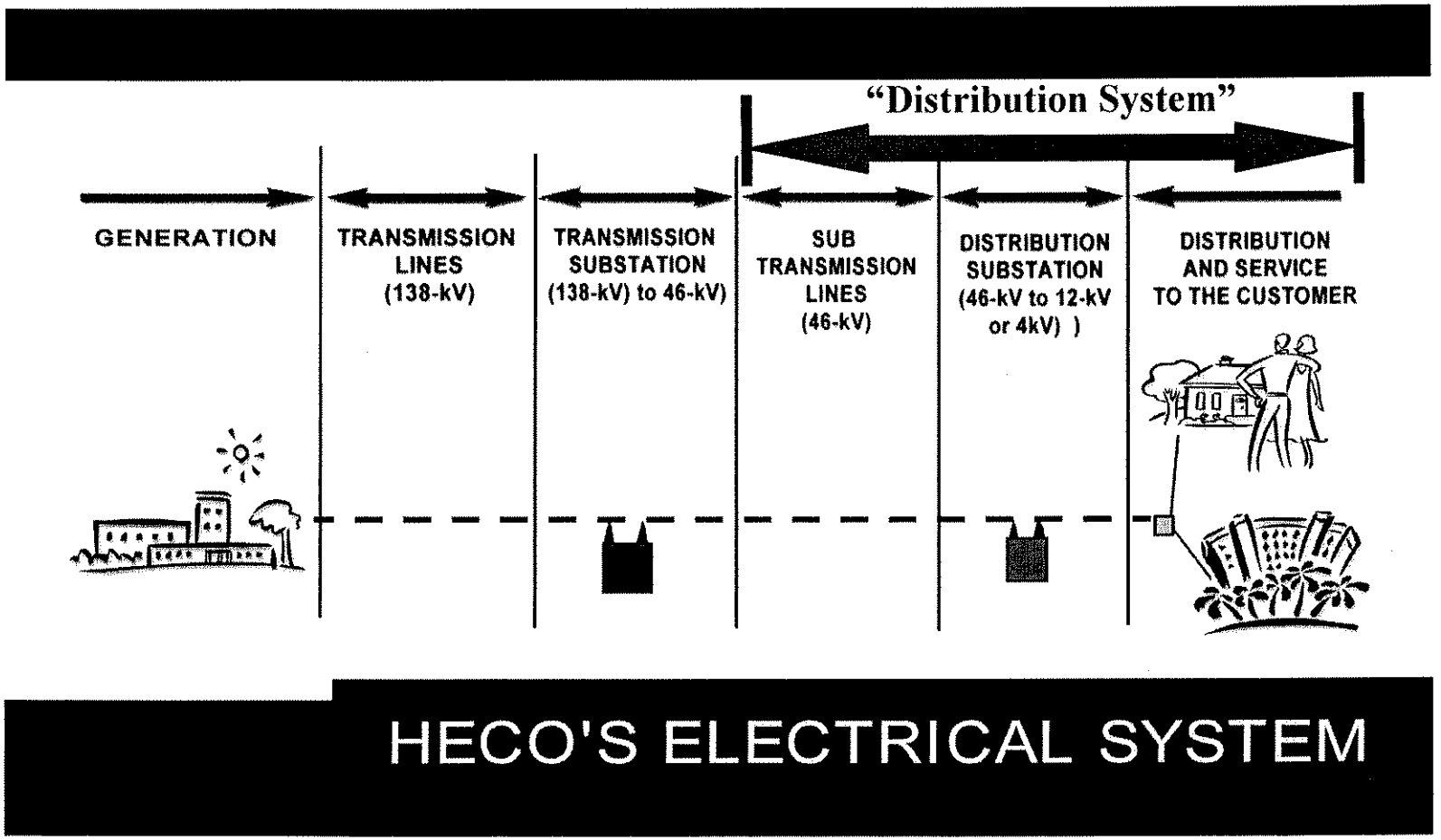
Presentation to IRP-3 Integration & DSM
Technical Committees

April 23, 2004

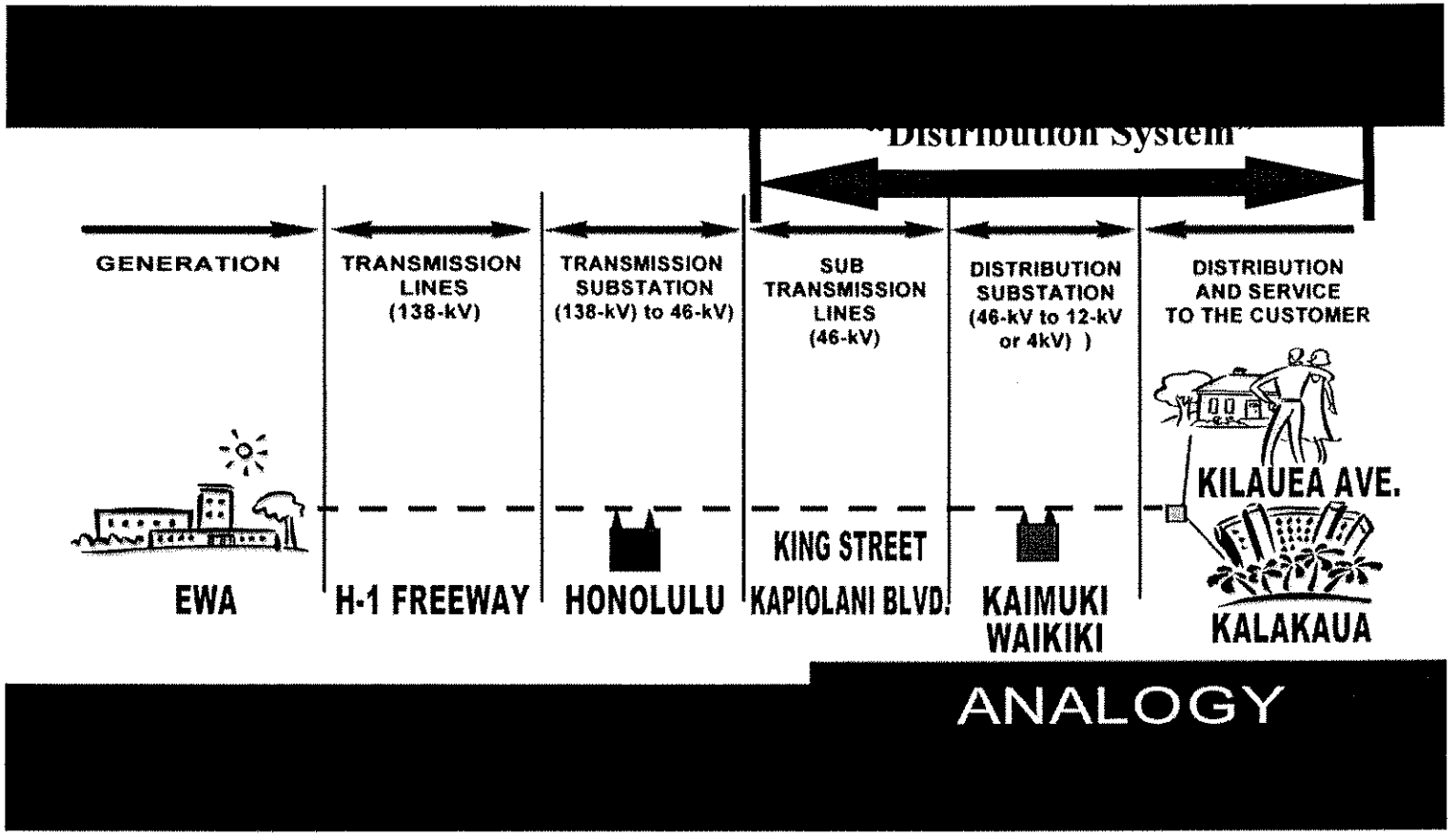
Objective of the Presentation

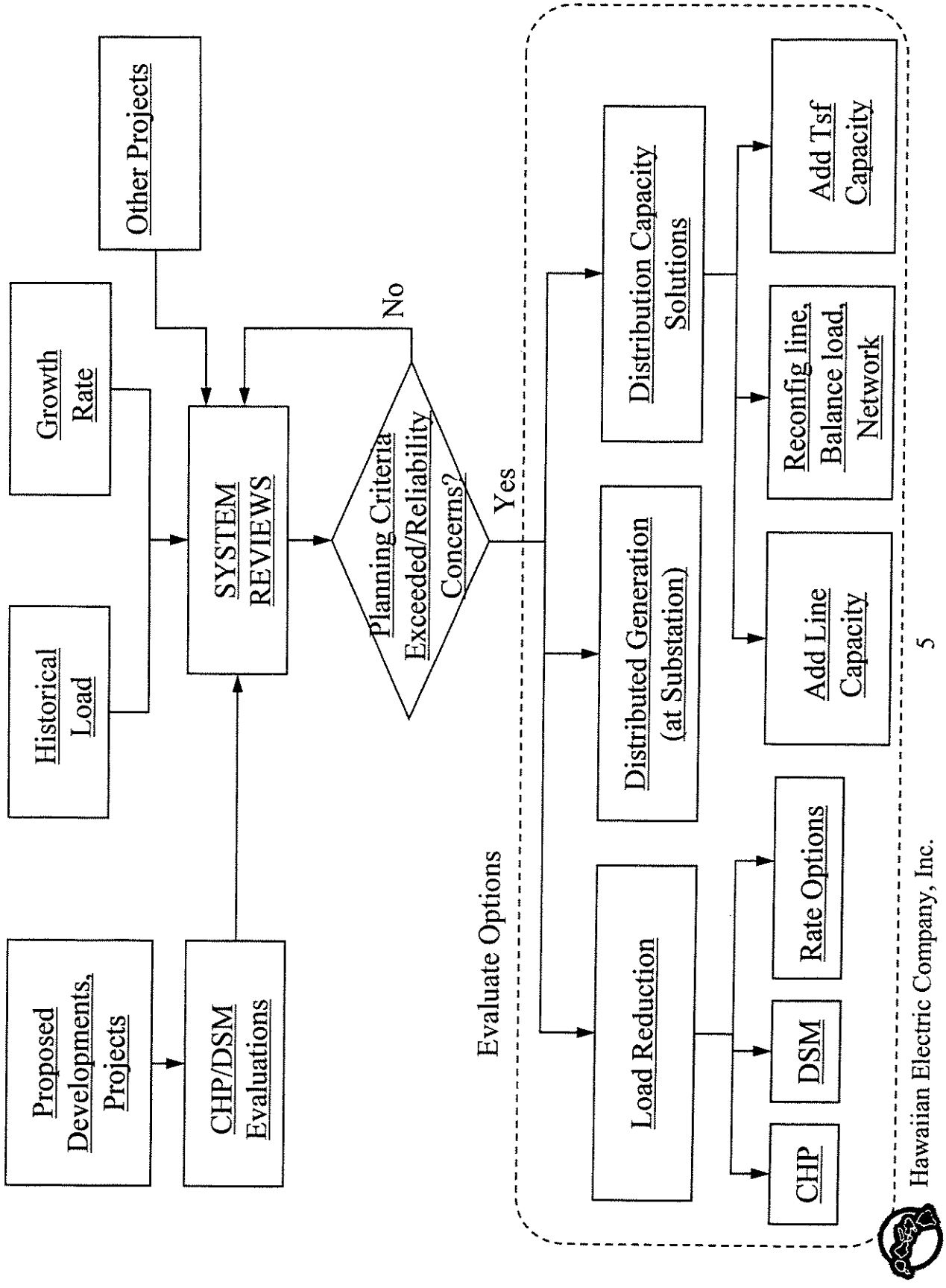
- Provide a review of HECO's Distribution Planning Process
- Illustrate that Distribution Planning Process is conducted in the manner which is consistent with the IRP Process

Distribution System



Distribution System




Other Projects
Growth Rate
Historical Load
Proposed Developments, Projects
SYSTEM REVIEWS
CHP/DSM Evaluations
Planning Criteria Exceeded/Reliability Concerns?
No
Yes
Evaluate Options
Distribution Capacity Solutions
Distributed Generation (at Substation)
Load Reduction
Add Tsf Capacity
Reconfig line, Balance load, Network
Add Line Capacity
Rate Options
DSM
CHP

Historical Load

- Part of load forecast is based upon recorded historical load
- Actual load demand from distribution substation transformers
- Readings from each individual distribution line

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Growth Rate

- Annual growth rate based upon historical trend
- Geographically dependent – cannot assume uniform growth for all areas of the island

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System Load Forecasting

- Load is forecasted for each transformer and each line
- Use actual load data from the previous year and add expected load growth for future years (based on historical growth rate)
- Load growth can be in form of new customers or existing customers increasing their load

Sample Forecast

	2002Act	2003	2004	2005	2006	2007
Moiliili 1 Line	4174kVA	5424kVA**	5478kVA	5533kVA	5588kVA	5644kVA
Moiliili 2 Line	4359kVA	4403kVA	4447kVA	4492kVA	4536kVA	4582kVA
Moiliili 1 Tsf	8533kVA	9827kVA	9925kVA	10024kVA	10125kVA	10226kVA

* Using a 1% growth rate ** New Iolani School load (1250kVA) in 2003

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Proposed Developments, Projects

- Customer Service Requests (Customer Installation Department)
- Energy Services Department – account managers
- Forecast Division
- Media (newspapers, television, etc.)
- Professional contacts

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CHP/DSM Evaluations

- Energy Solutions (customer's choice)
- Combined Heat and Power
- Demand Side Management

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Other Projects

- Governmental agencies projects (i.e. line relocation, improvement districts, etc.)
- Safety
- Increase reliability
- External distributed generation projects

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System Load Forecasting

- Distribution load forecasting is geographically dependent and therefore very dynamic
- High variability in growth rates between lines
- Highly dependent upon customer plans (ex. – a new hotel can double the load on a distribution line)
- Useful forecasting for distribution system rarely exceeds five years
- Is not based upon IRP 20-year sales and peak forecast

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System Reviews

- Both subtransmission and distribution systems (Planning horizon: 3 – 5 years)
- Each individual transformers (~270) and lines (~440) are analyzed
- Normal loading
- Emergency loading (single contingency)
- Voltage analysis, power quality, customer complaint
- Review of all existing system & customer projects

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Planning Criteria

- Purpose of the criteria is to establish consistent guidelines for planning a reliable distribution system for HECO & its customers
- The distribution system shall be planned on the basis of serving the predicted peak kva on any part of the system each year

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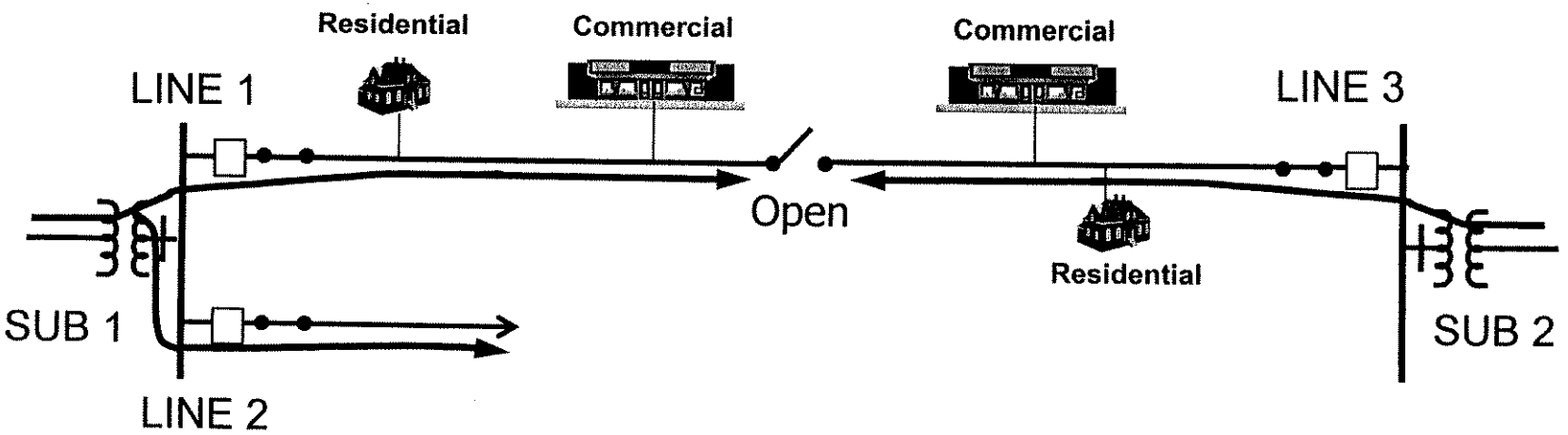
Normal Loading

- System equipment (transformer and line) needs to be able to handle normal load.



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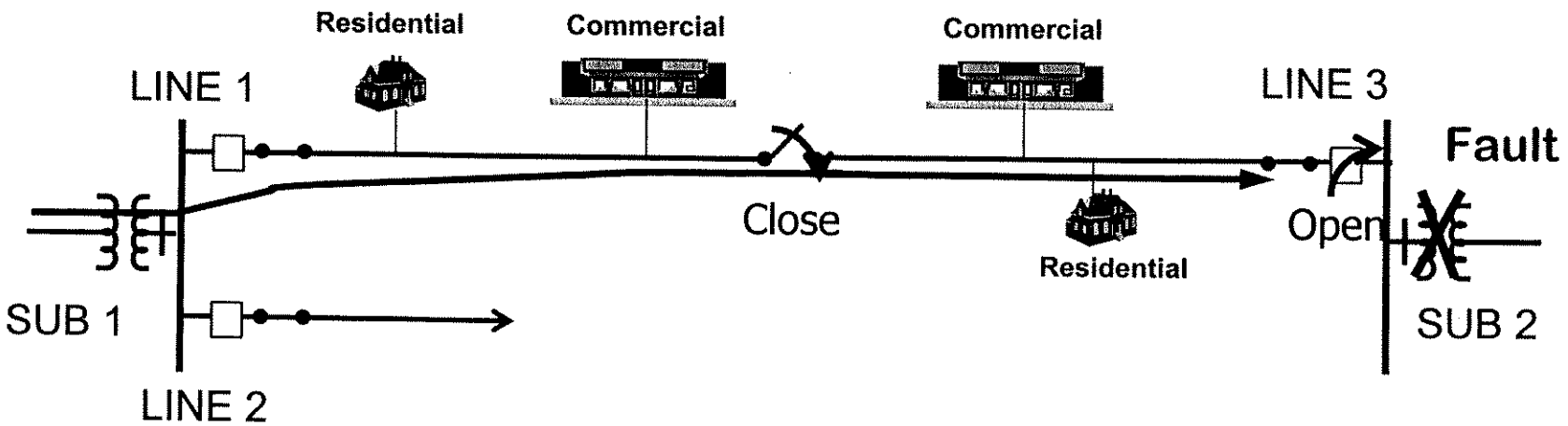
Backup Loading

- System equipment (transformer and line) needs to be able to backup adjacent line customers.



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Need for Projects

- Normal loading exceeds normal rating of system equipment
- Emergency loading exceeds emergency rating of system equipment
- Voltage conditions outside tariff limit
- To increase reliability
- Safety (new regulations or industry standards)
- Statutory or customer project requests (ex. – line relocation)

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Planning Criteria Exceeded?

- If no planning criteria violations occur, then the analysis is documented
- If planning criteria violations occur, then solutions are identified and evaluated
- Review with Community Relations Department regarding the potential of projects in the areas
- Options include load reduction, distributed generation at substation, and distribution capacity solutions

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Load Reduction

Distribution substation transformer and line load reduction

- CHP
- DSM
- Rate Options

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CHP

Evaluate CHP option to reduce line and transformer load

- Utilize waste heat from power generation process as energy for heating or cooling purposes
- Small scale generating units located at the customer load

- Dependent upon customer acceptance

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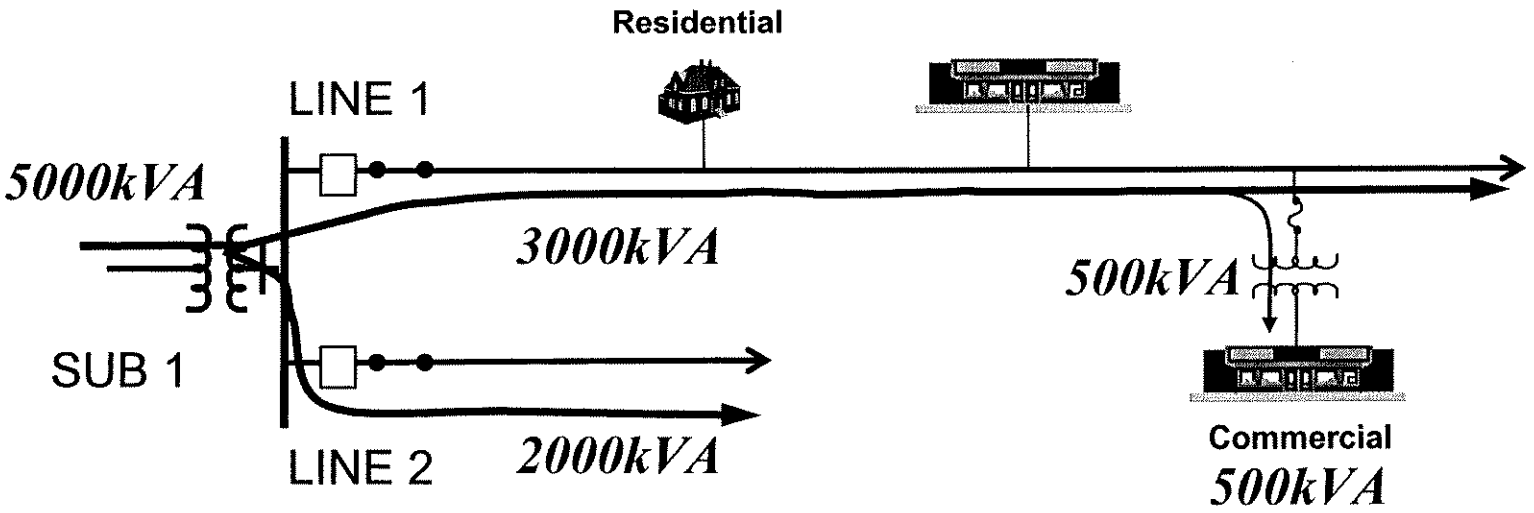
DG on Distribution System

- Reduces load on transformer and line



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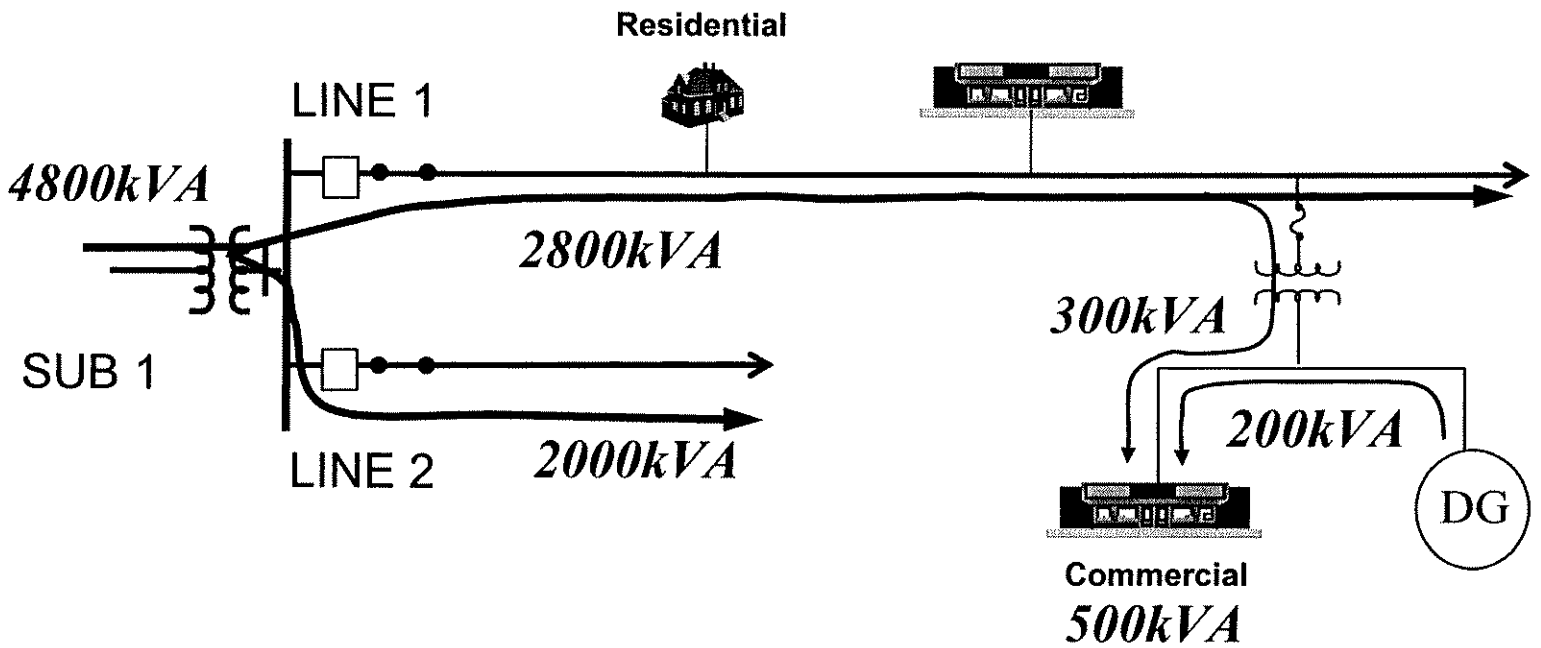

DSM

Evaluate DSM options to reduce line and transformer load

- Work closely with customers
- Assess potential for prescriptive and customized energy efficiency projects
- Possible to reduce the overall load on the line and transformer with targeted marketing efforts

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Rate Options

Evaluate rate options to reduce line and transformer load

- Time of use rates
- Interruptible rates

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Distributed Generation (at Substation)

Utilize existing substation sites for installation of DG to provide transformer capacity

- Does not solve distribution line overload

Dependent upon the following

- Community input
- Permits (noise, air, zoning, regulatory approvals)
- Fuel storage and supply
- Physical size restriction at substations
- Interconnection standards

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Distribution Capacity Solutions

- Reconfigure line, balance load, network
- Add line capacity
- Add transformer capacity

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Reconfigure Lines, Balance Load

- Load balance among the three phases
- Line reconfigurations to spread out loads among adjacent circuits
- Networking lines to maximize available capacity
- Affect transformers loading and upstream lines

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Add Line Capacity

- Install line capacitor
- Reconductor overhead conductor with larger size / higher ampacity conductor
- Replace existing cable with larger size cable
- Voltage conversion (4kV to 12kV, 12kV to 25kV)
- Install new line

- Review the upstream effect

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Add Transformer Capacity

- Add fans to increase capacity rating
- Replace existing unit with a larger capacity unit
- Install new transformer at existing substation
- Install new transformer at new substation

- Review upstream effect

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Evaluation of Solutions

- Possible solutions are identified and analysis is performed to determine if these solutions resolve the Distribution Planning Criteria violations
- A solution that resolve the violations is selected to be implemented.