Integrated Grid Planning

Joint DPWG & GSWG Meeting

April 25, 2019

Agenda

9:00-9:30 Introduction & Scope

- Ground rules
- Soft Launch Purpose & Objectives
- Revised Definitions NWA & Distribution Capacity Deferral Service

9:30-11:30 Distribution Grid Needs Assessment (break at 10:15)

Review engineering analysis of needs associated with:

- Hoopili
- East Kapolei

11:30-12:00 Lunch

12:00-2:00 Soft Launch Distribution Investment Deferral Opportunity

- Discussion of Kapolei opportunity & performance requirements
- Initial discussion of proposal criteria

2:00-2:15 Wrap-up & Next Steps

Ground Rules

- Chatham House Rule will apply – no personal or organizational attribution will be made to any comments/feedback provided during the meeting by any participant nor in written documentation.
- Working group meetings, and other information exchanges are intended solely to provide an open forum or means for the expression of various points of view in compliance with antitrust laws.
- Under no circumstances shall engagement activities be used as a means for competing companies to reach any understanding, expressed or implied, which tends to restrict competition, or in any way, to impair the ability of participating organizations to exercise independent business judgment regarding matters affecting competition or regulatory positions.
- Proprietary information shall not be disclosed by any participant during any industry engagement meeting or information exchange. In addition, no information of a secret or proprietary nature shall be made available to industry engagement participants.
- All proprietary information which may nonetheless be publicly disclosed by any participant during any industry engagement meeting or information exchange shall be deemed to have been disclosed on a non-confidential basis, without any restrictions on use by anyone, except that no valid copyright or patent right shall be deemed to have been waived by such disclosure.

Soft Launch Purpose & Objectives

Purpose:

- IGP Soft Launch is intended to ***demonstrate*** the grid needs planning, solution sourcing processes and evaluation methods for distribution non-wires alternatives.

Objectives:

- Soft Launch will help inform development of the full scale IGP planning and sourcing effort beginning in 2020.
- Soft Launch is focused on one distribution substation capacity deferral need that can be reasonably addressed by NWA.
- Soft Launch will commence with sourcing and evaluation in 2019 and continue with anticipated solution deployment in 2020-21 and operational testing by 2022.
- Soft Launch will be informed by and provide learnings to Market WG activities.

Soft Launch Demonstration Scope

- Identify distribution capacity deferral service for demonstration.
  - Identify a distribution opportunity that has sufficient value and performance requirements that may be met by a variety of potential NWA providers
  - Distribution NWAs have several different requirements and considerations that need to be explored.
  - As such, not seeking procurement of other services as part of NWA demonstration to focus on successful implementation and incorporate learnings into IGP
  - Other current opportunities for ancillary services
- Identify deferral opportunity that can be operational by 2022
  - Goal to inform IGP NWA sourcing & evaluation in 2020
  - Provide adequate time for implementation of providers' solution and testing
  - Goal inform implementation stage of IGP
- DER technology agnostic and will consider provider solutions behind the meter and/or ahead of meter
  - Providers may make multiple solution proposals or combinations of proposals to satisfy the distribution need

Revised Definitions based on Feedback

NWA Definition:

An electricity grid project that uses non-traditional transmission and distribution (T&D) solutions, such as distributed generation (DG), energy storage, energy efficiency (EE), demand response (DR), and grid software and controls, to defer or avoid the need for conventional transmission and/or distribution infrastructure investments.

Sources: Adapted from Navigant, DOE and E4TheFuture, PLMA & SEPA, Non-wires Alternatives: Case Studies from Leading US Projects

Distribution Capacity Service Definition:

A supply and/or a load modifying service that DERs provide as required via the dispatch of power output for generators and electric storage, and/or reduction in load that is capable of reliably and consistently reducing net loading on desired distribution infrastructure. These Distribution Capacity services can be provided by a single DER resource and/or an aggregated set of DER resources that reduce the net loading on a specific distribution infrastructure location coincident with the identified operational need in response to a control signal from the utility.

Sources: Adapted from California IDER Working Group

NWA Performance Parameters

- MW/MVA size
  - Mitigate the year's worst scenario with a percent margin
- Daily duration in hour
  - Based on the year's longest daily duration.
- Delivery month
  - When planning criteria violations occurs.
- Delivery days
  - Requires all week days of a week if overloading issue is identified on any week day of the week.
  - Requires all weekend days of a week if overloading issue is identified on any weekend day or holiday of the week.
- Max. number of calls per year
  - Total number of days required per above rules for overloading mitigation, and at least one month of week days or weekend days, if mitigation is only required for week day or weekend day.

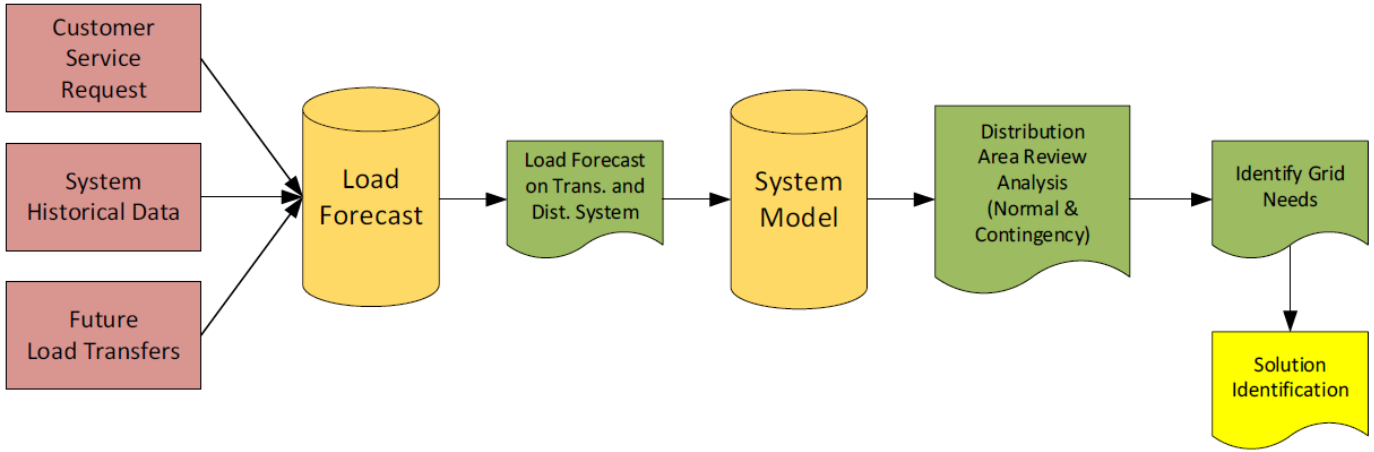
Distribution Grid Needs Assessment

Grid Needs Assessment

- Distribution Planning Process
  - High level planning process description
  - Important planning concepts
- Study Objectives and Scope
- Methodology of Analysis
- West Region Planning Area Distribution Needs Assessment
  - Ho'opili Area Review
  - East Kapolei Area Review
- Preliminary Analysis Results
  - NWA requirements
  - Traditional "wires" requirements

Distribution Planning Process

- High Level Planning Process

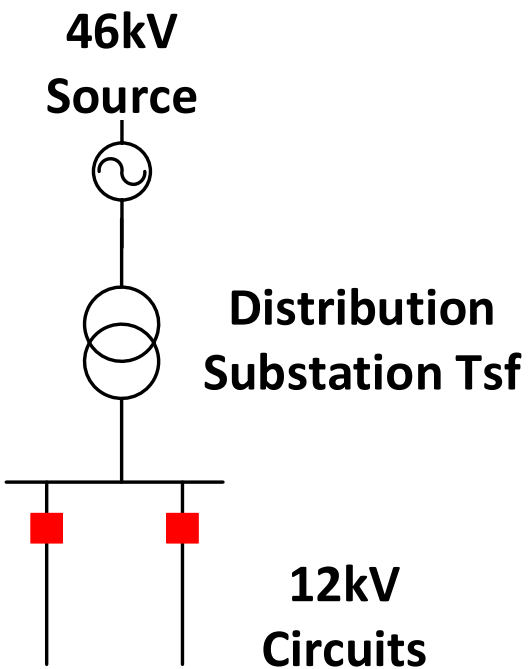


Distribution Planning Criteria

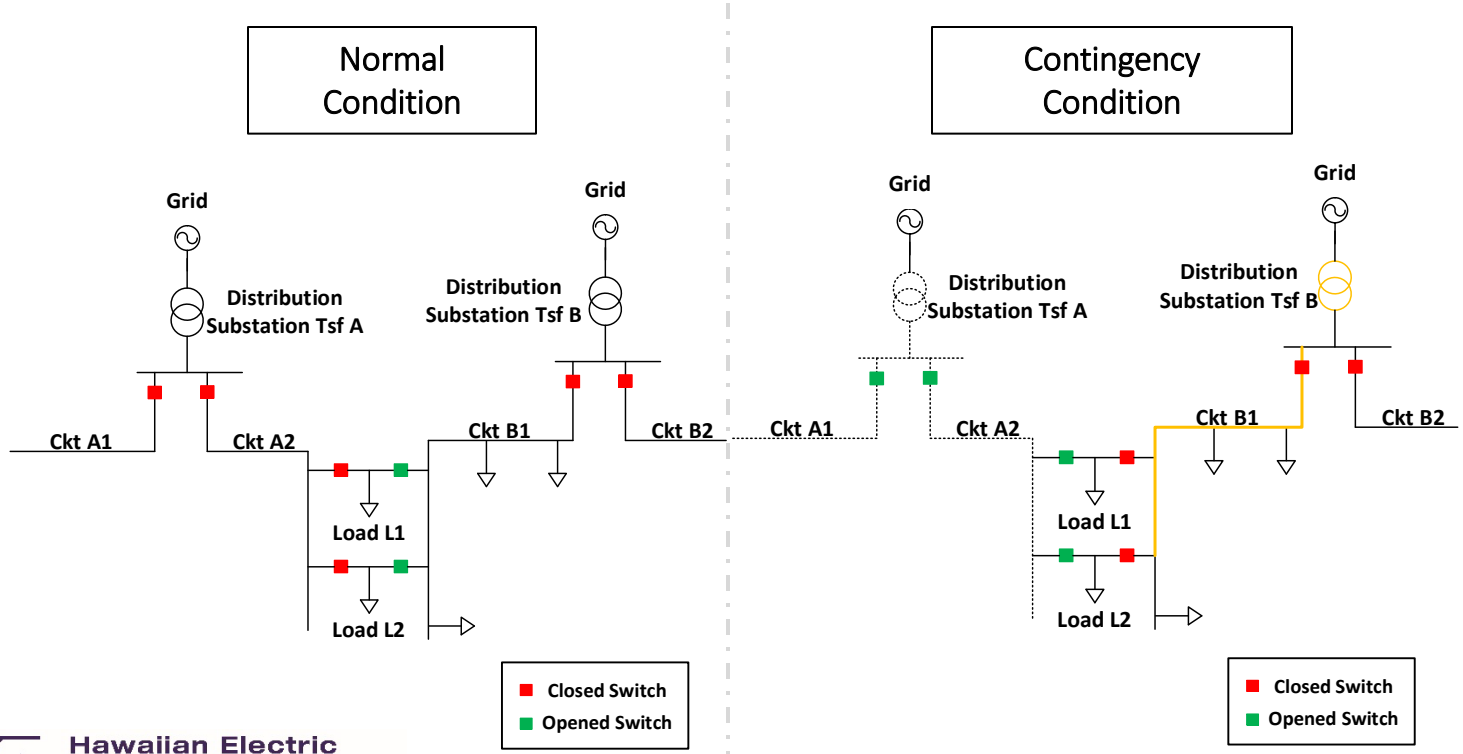
- Important Planning Concepts – Planning Criteria
  - Company's equipment loading criteria
    - Substation transformer
      - Normal condition thermal (kVA) rating and contingency condition kVA rating
      - Contingency condition rating is 1.1x to 1.4x of normal condition kVA rating.
    - Distribution circuit
      - Normal condition – normal rating ampacity
      - Contingency condition – emergency rating ampacity
      - Contingency condition rating is 1.1x to 1.4x time of normal contingency kVA rating.
  - Other criteria
    - Voltages
    - Power Quality

Typical HECO Distribution Transformer/Circuit Arrangement

- Typical 46-12kV Transformer and Circuit
  - 10/12.5 MVA Transformer Size
  - Two 12kV Circuits per transformer
  - Approximately 3-6 MVA loading per circuit



Distribution Planning Process – Planning Concepts



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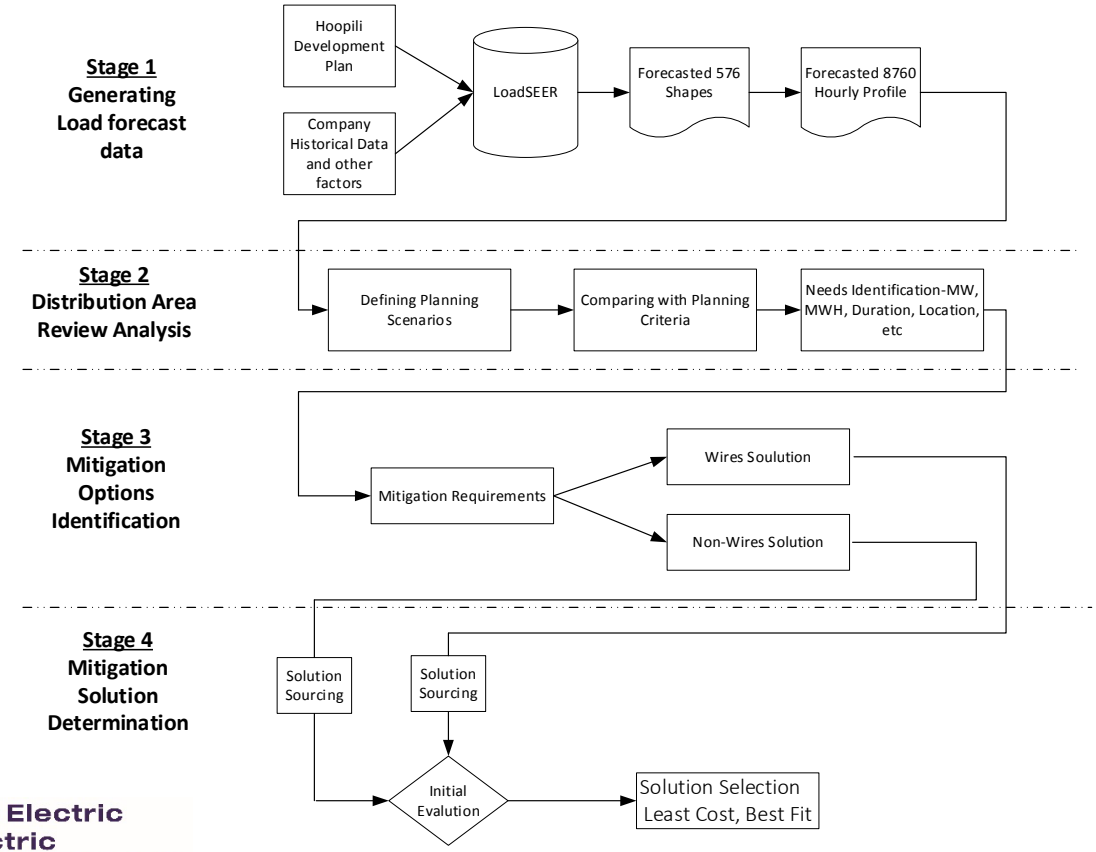
Study Objectives and Scope

- Identify distribution system needs and related engineering requirements
- Identify options to mitigate the planning criteria violations
  - Potential NWA opportunities and performance requirements
  - Traditional “wires” solutions

Methodology of Analysis



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Methodology of Analysis

- Assumptions
  - New load energized at beginning of every year
  - 8760 hourly profile generated from 576 shapes from LoadSEER load forecast
    - Historical SCADA data
    - Load projections provided by customers and developers
    - Utilized LoadSEER's 1 day in 2 year hottest weather day forecast 576 shapes to populate 8760 hourly curve for each year from 2019 to 2030.
  - Load power factor assumption
    - Circuit level: 0.95 inductive
    - Substation transformer level: 0.92 inductive
  - Contingency modeling
- Planning scenarios considered in the study
  - Normal conditions
  - Contingency conditions
- Study Period: 5-10 Year

West Region Planning Area Distribution Needs Assessment

- Ho'opili Area Distribution Capacity Study
  - Load growth description
  - Distribution transformers and circuits involved in the study
  - Planning criteria violation summary
  - Mitigation plan
- East Kapolei Area Distribution Capacity Study
  - Load growth description
  - Distribution transformers and circuits involved in the study
  - Planning criteria violation summary
  - Mitigation plan

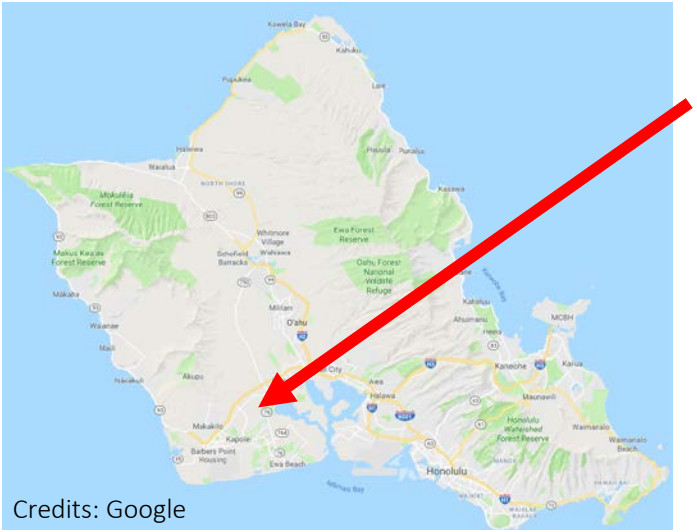
Ho’opili Area Capacity Study

- Driven by future Ho’opili Subdivision development
- Address system needs to accommodate new loads

Ho’opili Area Capacity Study

- Load growth description

Total 19 phases development,
from 2018 to 2030



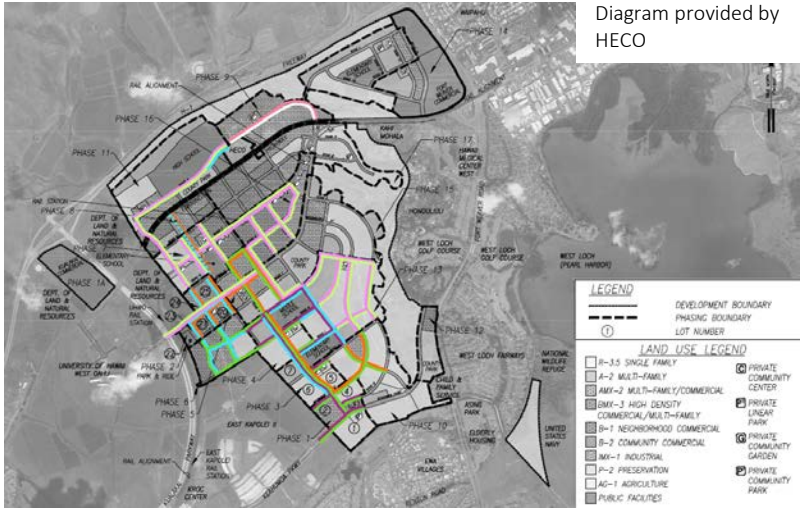
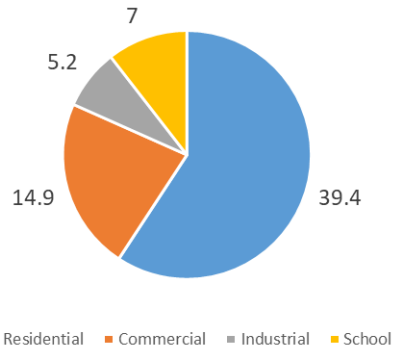


Diagram provided by HECO

Ho'opili Sub-Division Load Composition (MVA)



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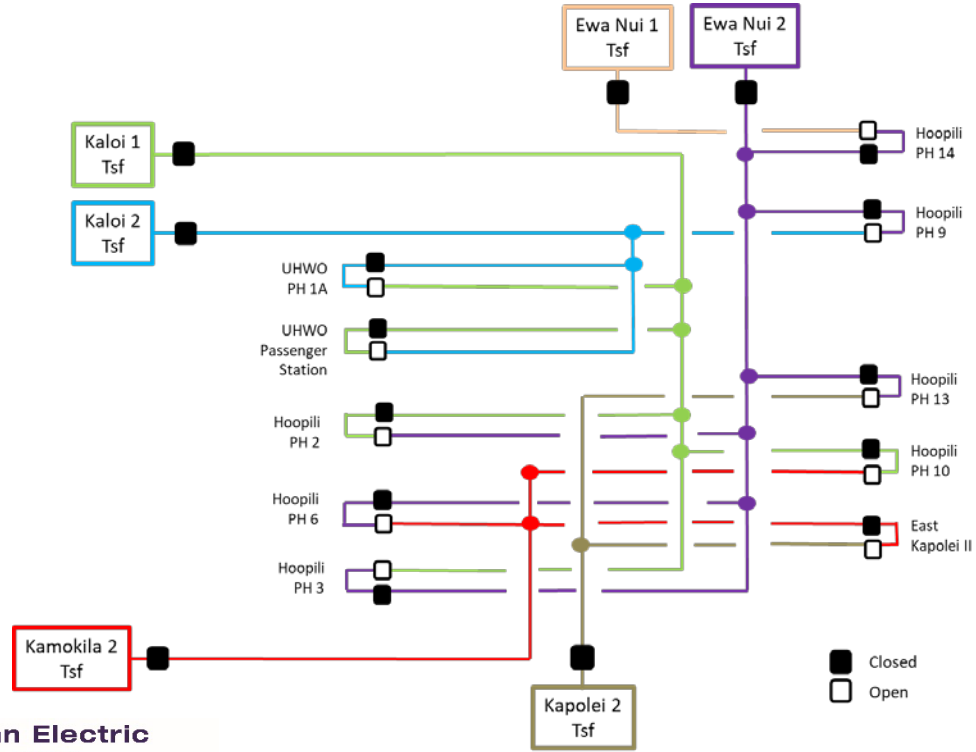
Ho’opili Area Capacity Study

- Distribution transformers and circuits involved in the study



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Ho'opili Area Capacity Study

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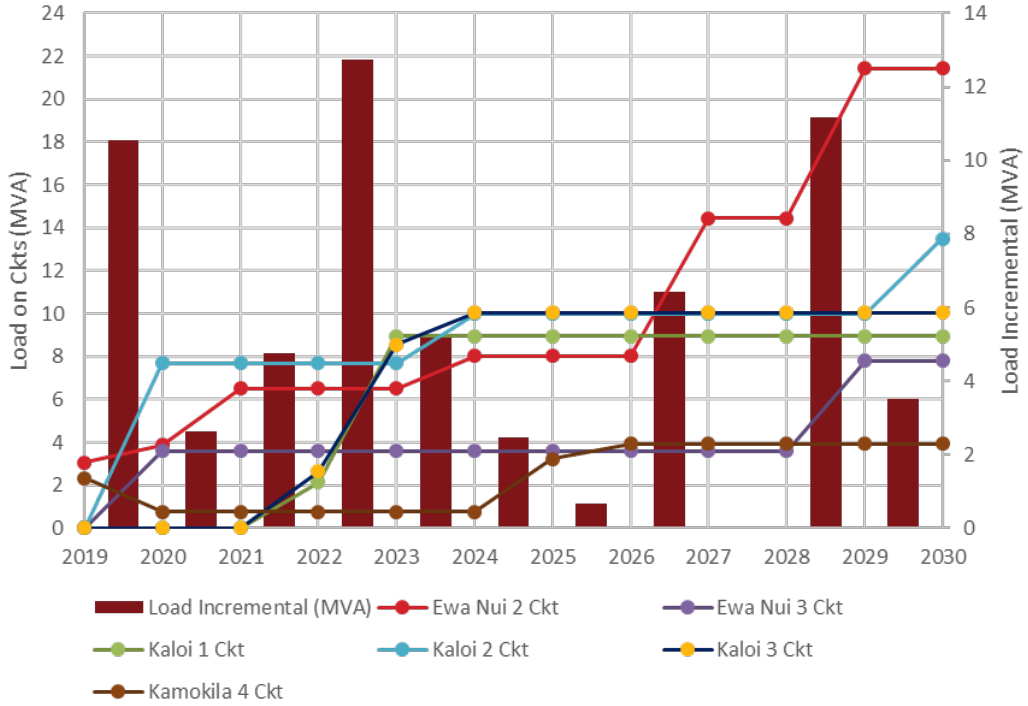


New Ho'opili Load Additions

- Kamokila 2 Tsf
  - Kamokila 4 Ckt – 3.9 MVA
- Ewa Nui 2 Tsf
  - Ewa Nui 2 Ckt – 21.4 MVA
  - Ewa Nui 3 Ckt – 7.8 MVA
- Kaloi 1 Tsf
  - Kaloi 1 Ckt – 9 MVA
  - Kaloi 2 Ckt – 13.5 MVA
- Kaloi 2 Tsf
  - Kaloi 3 Ckt – 10.1 MVA

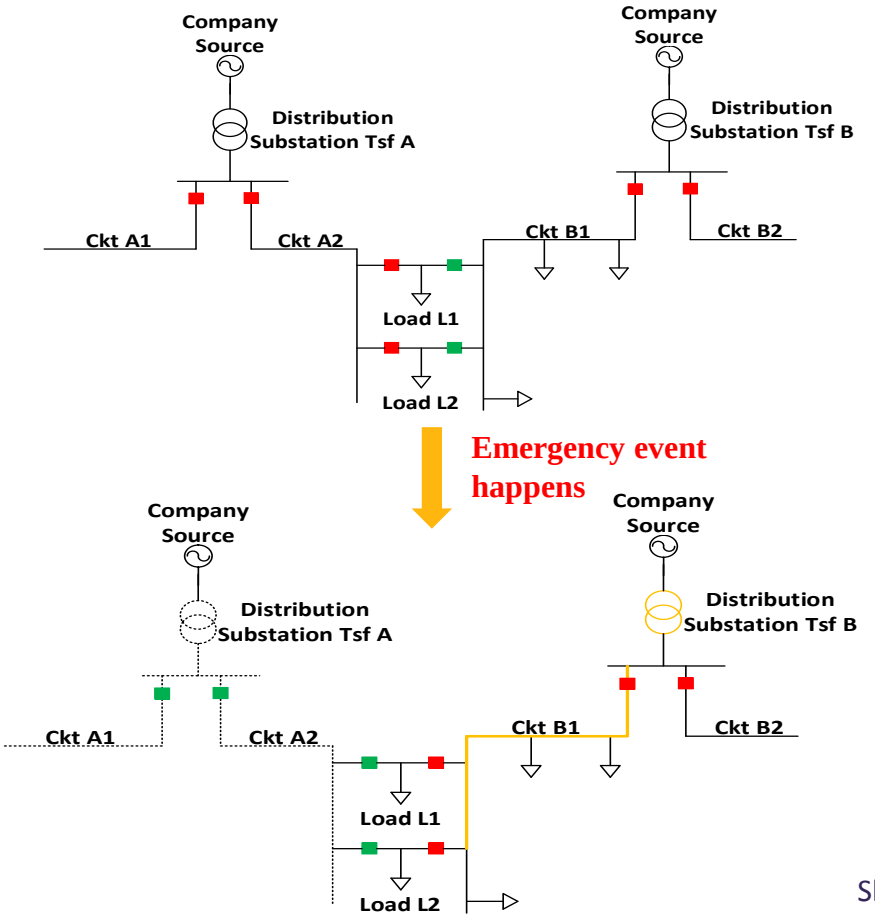
Largest load growth occurs between:

- 2019 to 2020
- 2022 to 2023
- 2028 to 2029

Ho'opili Area Capacity Study

Contingency Conditions

- Kamokila 2 Tsf
  - Loss of Ewa Nui 2 Tsf
  - Loss of Kaloi 1 Tsf
- Kapolei 2 Tsf
  - Loss of Kamokila 2 Tsf
  - Loss of Ewa Nui 2 Tsf
- Ewa Nui 2 Tsf
  - Loss of Kaloi 1 Tsf
- Ewa Nui 1 Tsf
  - Loss of Ewa Nui 2 Tsf
- Kaloi 1 Tsf
  - Loss of Ewa Nui 2 Tsf
  - Loss of Kaloi 2 Tsf
- Kaloi 2 Tsf
  - Loss of Kaloi 1 Tsf
  - Loss of Ewa Nui 2 Tsf



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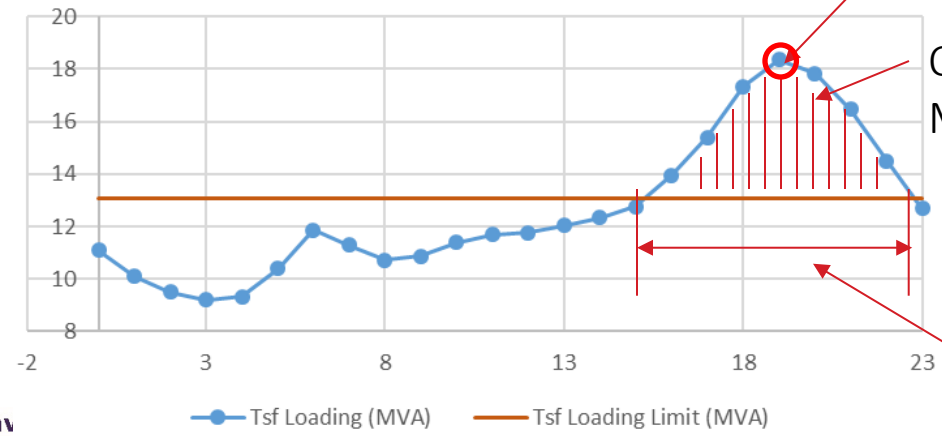
Ho’opili Area Capacity Study

- Planning criteria violation summary
  - Ho’opili area review
  - Transformer/Circuit level overloading review
- Mitigation Plan
  - Focused on recent 5-year plan
  - Potential NWA opportunities
  - Wires Solution

Ho’opili Area Review

- Ho’opili Area Review
  - How many Tsfs/Ckts are projected to have planning criteria violations?
  - How many days are projected to have criteria violations?
  - What is the max. overloading (MVA) for each year?
  - What is the max. single day duration overload for each year?
  - What is the max. single day overload (MWh) for each year?



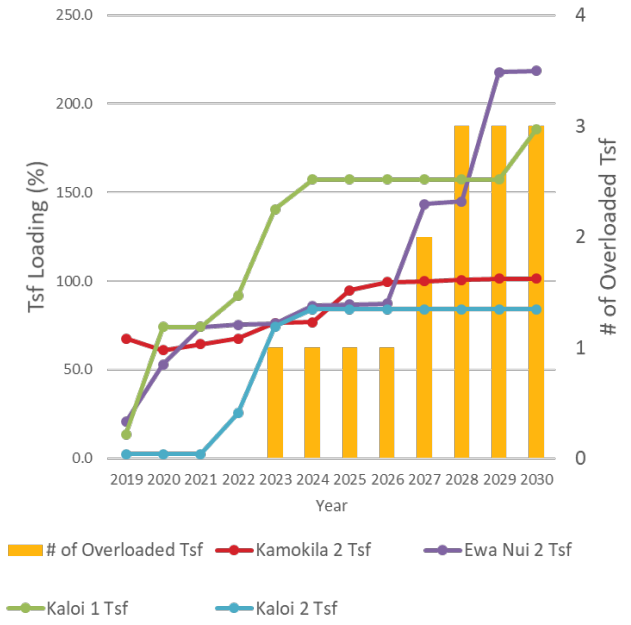
Max. Overloading MVA

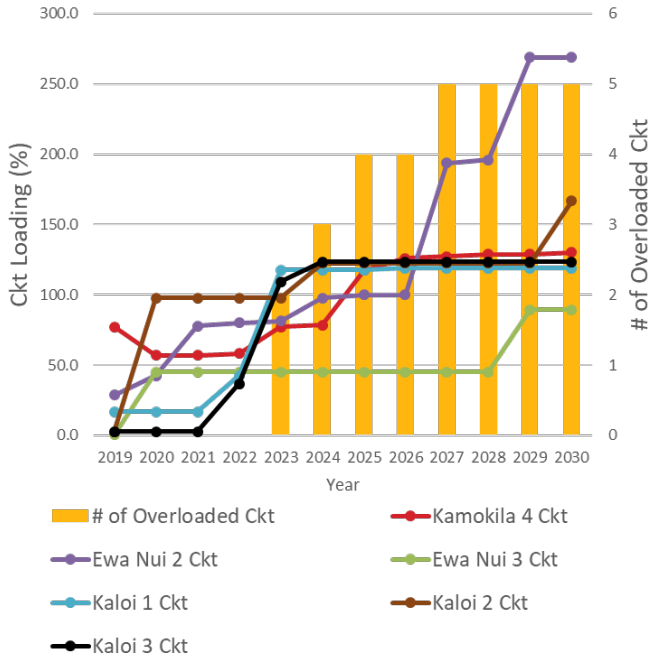
Overloading MWH

Duration of overloading

Ho’opili Area Review

- How many Tsfs/Ckts are projected to have planning criteria violations
  - Normal Condition





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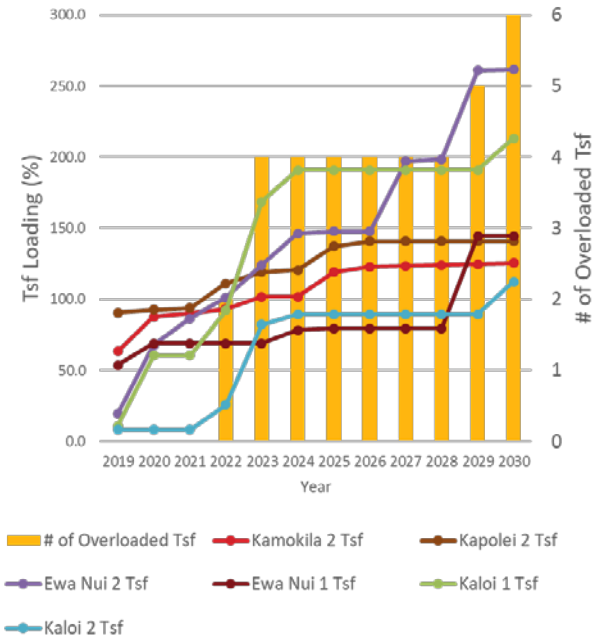
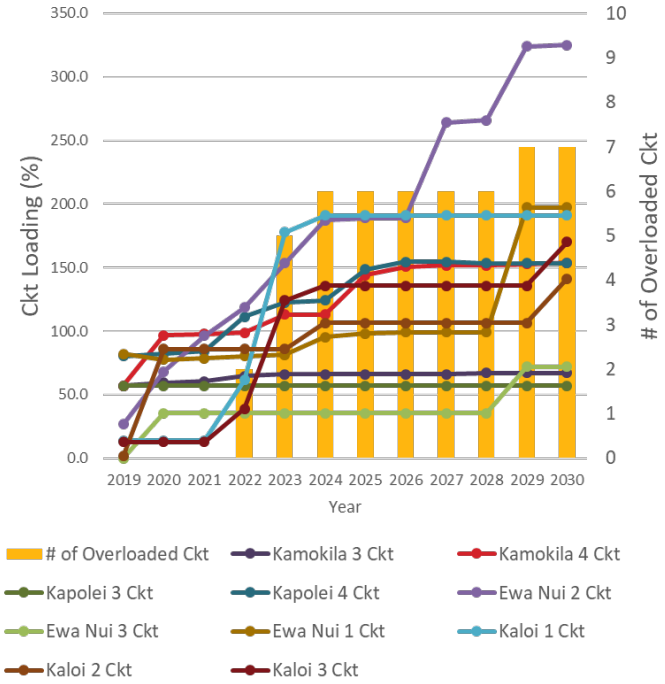
Ho’opili Area Review

- How many Tsfs/Ckts are projected to have planning criteria violations
  - Contingency Condition





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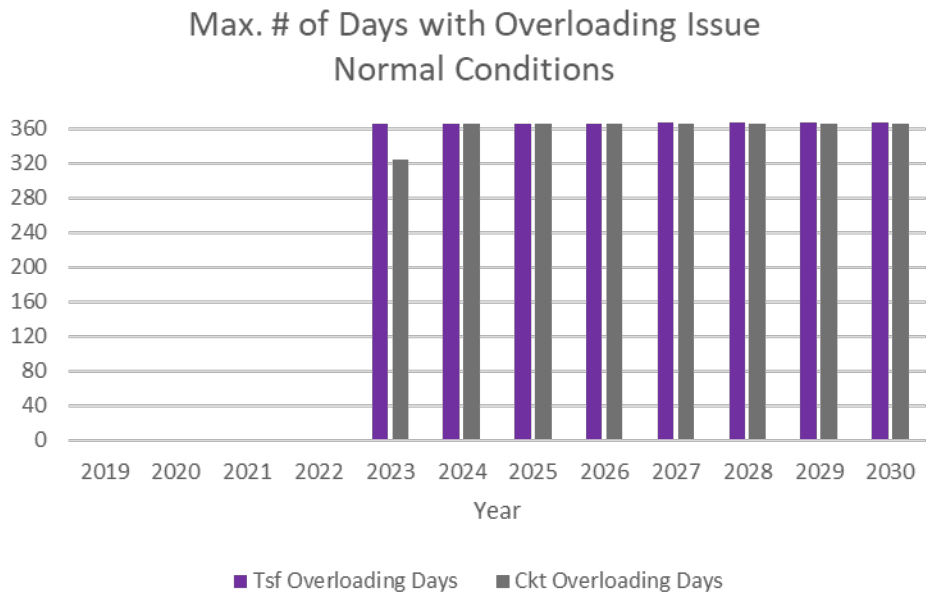
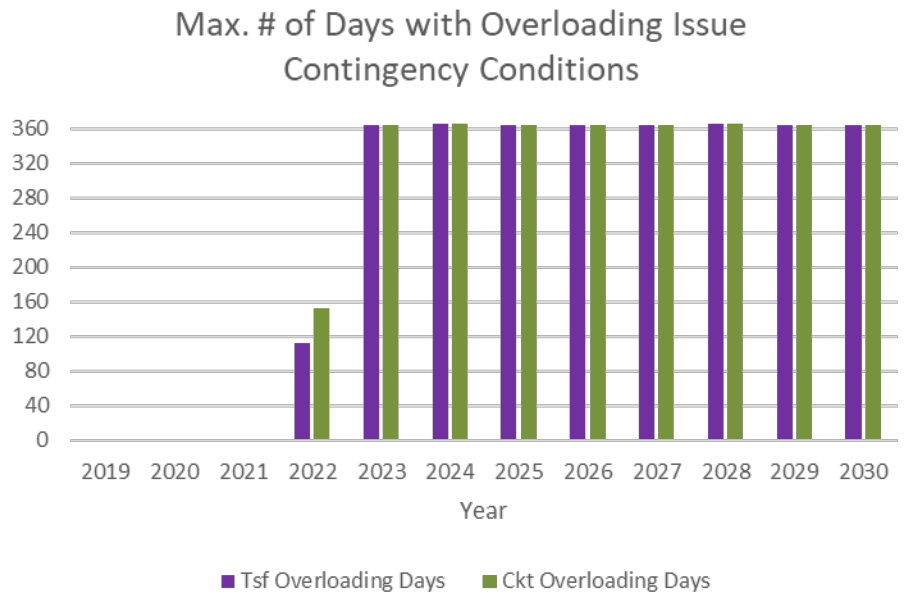
Ho’opili Area Review

- How many days are projected to have criteria violations?





Ho’opili Area Review

- Tsf/Ckt 24-Hr Loading Waveform of the Worst Scenario, from 2019 to 2024
  - Summary of Observation

Normal Condition	Year		
	2022	2023	2024
# of Tsf Overloaded	0	1	2
Max. Overloaded MVA on Tsf	0	4.7	6.9
Longest Overloaded Duration (Hr) on Tsf in a Day	0	7	12
Max. Overloaded MWH on Tsf in a Day	0	17.4	32.4
Max. Area Aggregated Overloaded MWH on Tsf in a Day	0	17.4	32.6
# of Ckt Overloaded	0	2	3
Max. Overloaded MVA on Ckt	0	1.3	1.7
Longest Overloaded Duration (Hr) on Ckt in a Day	0	5	5
Max. Overloaded MWH on Ckt in a Day	0	3.7	4.6
Max. Area Aggregated Overloaded MWH on Ckt in a Day	0	4.5	13.1

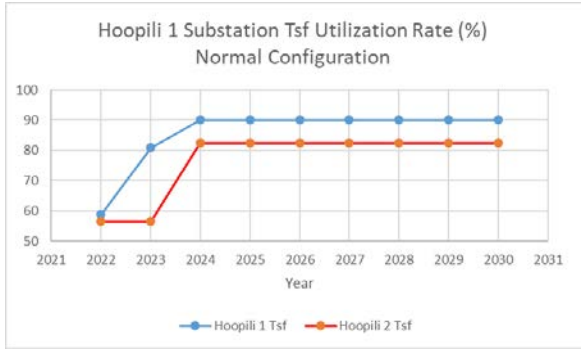
Contingency Condition	Year		
	2022	2023	2024
# of Tsf Overloaded	1	3	3
Max. Overloaded MVA on Tsf	2.3	10.3	13.8
Longest Overloaded Duration (Hr) on Tsf in a Day	8	13	21
Max. Overloaded MWH on Tsf in a Day	7.9	49.8	92
Max. Area Aggregated Overloaded MWH on Tsf in a Day	7.9	79.1	144.6
# of Ckt Overloaded	2	5	6
Max. Overloaded MVA on Ckt	1.3	7.8	9.1
Longest Overloaded Duration (Hr) on Ckt in a Day	4	19	21
Max. Overloaded MWH on Ckt in a Day	2.9	47.4	70.5
Max. Area Aggregated Overloaded MWH on Ckt in a Day	4.4	85.4	155.6

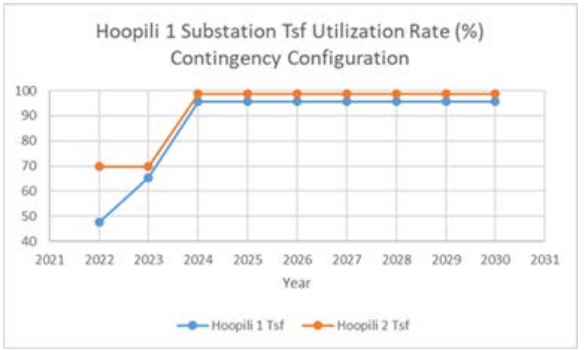
Ho'opili Area Review – Wires Solution

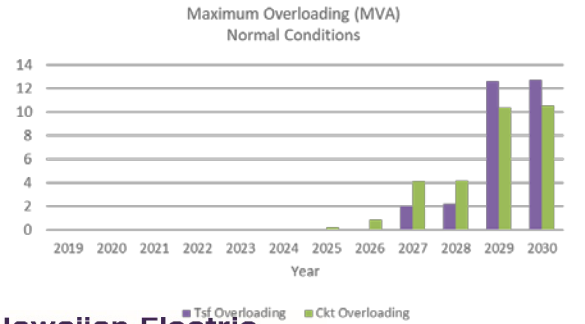
- Wires Solution
  - Addition of a new Hoopili substation to increase distribution capacity in the area
    - New substation will solve all overloads identified
    - New substation also increases the amount of DER hosting capacity in the area
    - The 10 year forecast shows additional substation capacity will be needed in 6-8 years. Future NWA opportunities will be available to defer future substation additions as the Hoopili sub-division develops over time

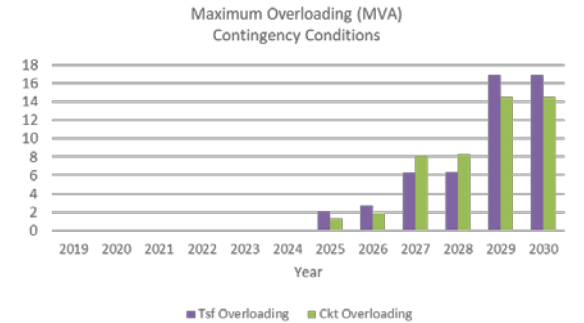
Ho'opili Area Review – Wires Solution

- Wires Solution – Installation of Ho'opili Substation
  - Utilization Rate = $\frac{Peak\ Load}{Loading\ Limit} * 100\%$









Ho’opili Area Capacity Study Summary

- Per forecast, Ho’opili area will have both transformer and circuit overloading from 2022 with critical overloading starting in 2023. Potential service reliability issues need to be addressed.
- The NWA opportunity was evaluated but unfortunately there was no practical opportunity based on stakeholder feedback.
- The plan is to build Ho’opili substation with two new transformers to address overloading issue from 2022.
- But even with the Ho’opili substation transformers, there are potential NWA opportunities for mitigating overloading issues from 2025 and those opportunities to be considered in IGP cycle next year.

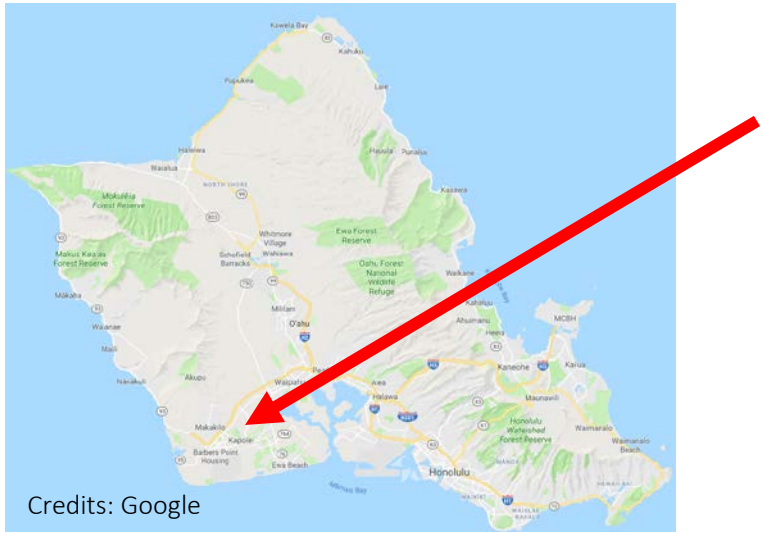
East Kapolei Area Capacity Study

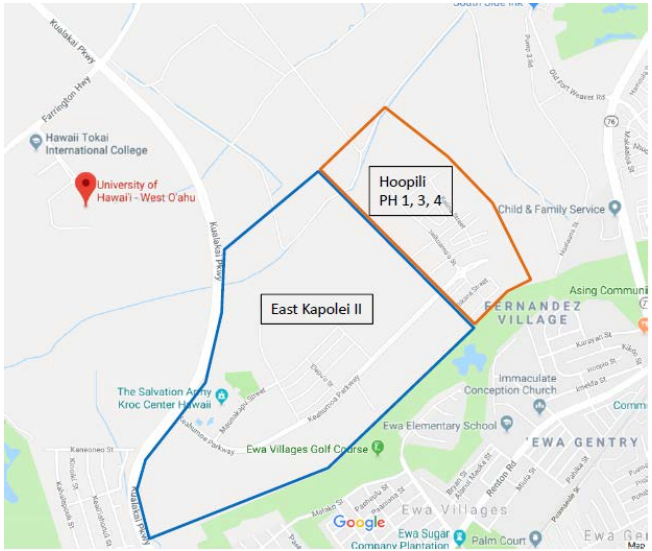
- Driven by future East Kapolei Subdivision and portion of Ho'opili Subdivision developments
- Address system needs to accommodate new loads

East Kapolei Area Capacity Study

- Load growth description

  10MW peak load growth from 2019 through 2025





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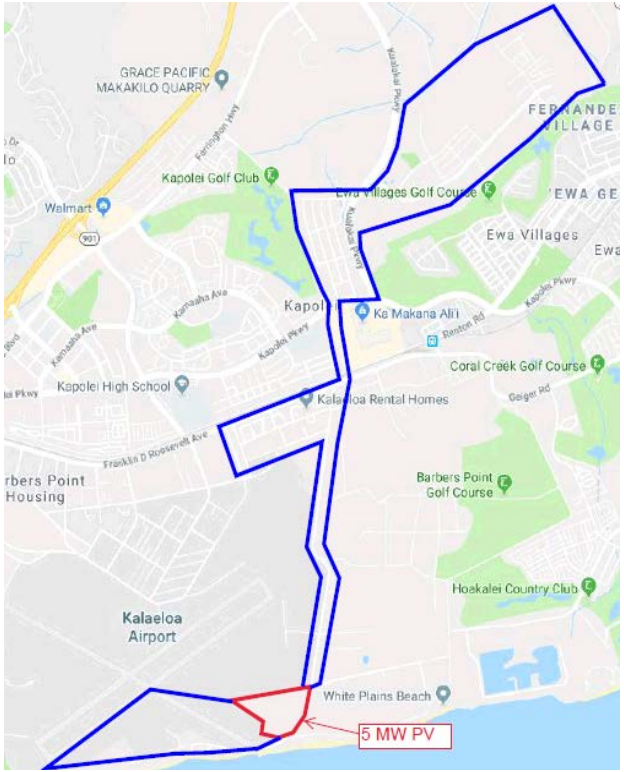
East Kapolei Area Capacity Study

- Forecasted planning criteria violation occurs from 2022 on Kapolei 2 Tsf and Kapolei 4 Ckt.

- NWA solution is required on Kapolei 4 circuit to address the loading violations of both Kapolei 2 Tsf and Kapolei 4 Ckt.



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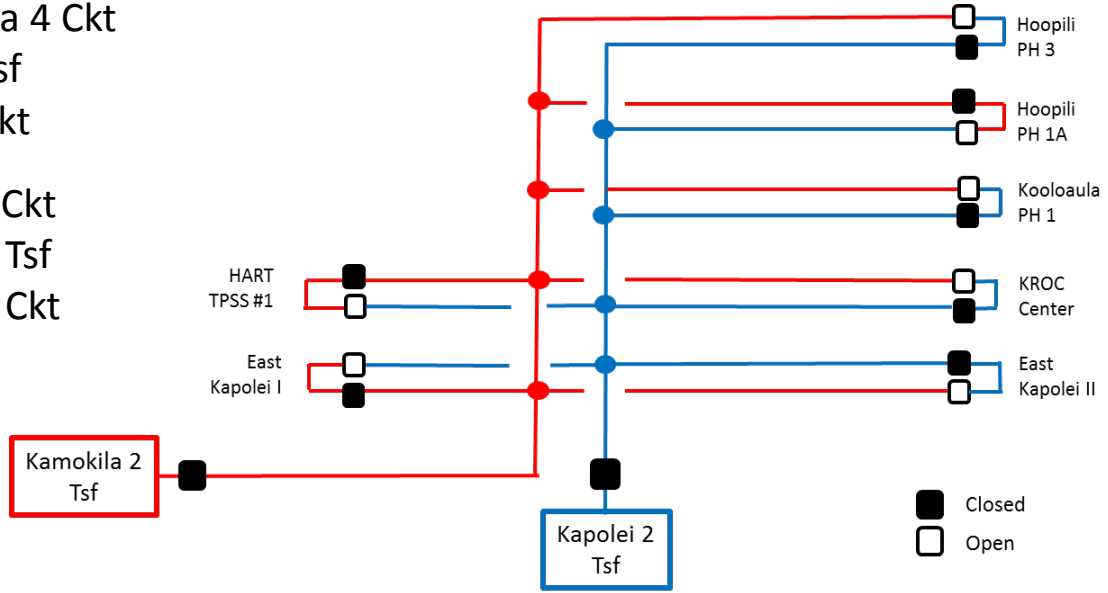
East Kapolei Area Capacity Study

- Distribution transformers and circuits involved in the study

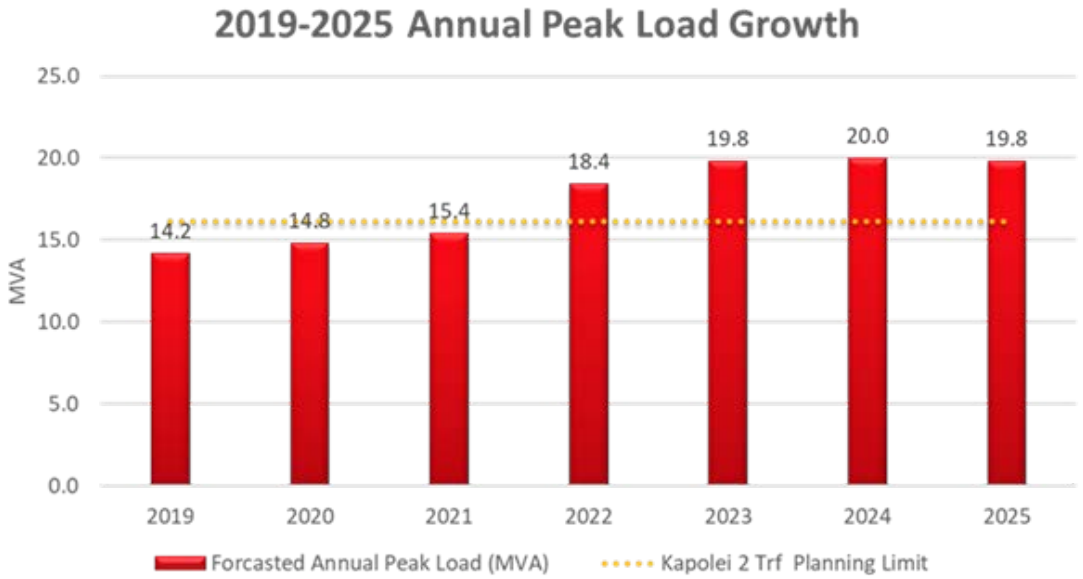
  Contingency Conditions

  - Kamokila 2 Tsf / Kamokila 4 Ckt
    - Loss of Kapolei 2 Tsf
    - Loss of Kapolei 4 Ckt
  - Kapolei 2 Tsf / Kapolei 4 Ckt
    - Loss of Kamokila 2 Tsf
    - Loss of Kamokila 4 Ckt



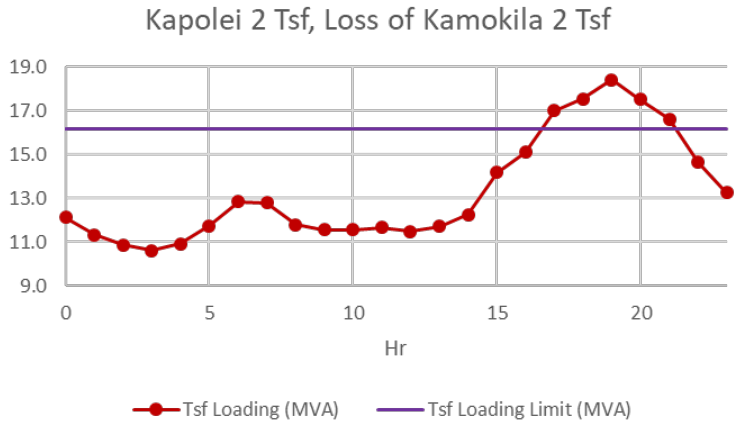
East Kapolei Area Capacity Study

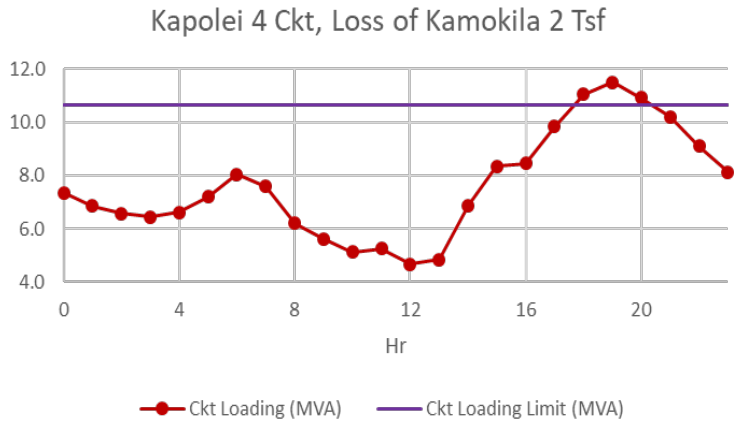
- Load Growth Description
  - Kapolei 2 Tsf annual peak load growth summary from 2019 to 2025 (with contingency)



East Kapolei Area Review

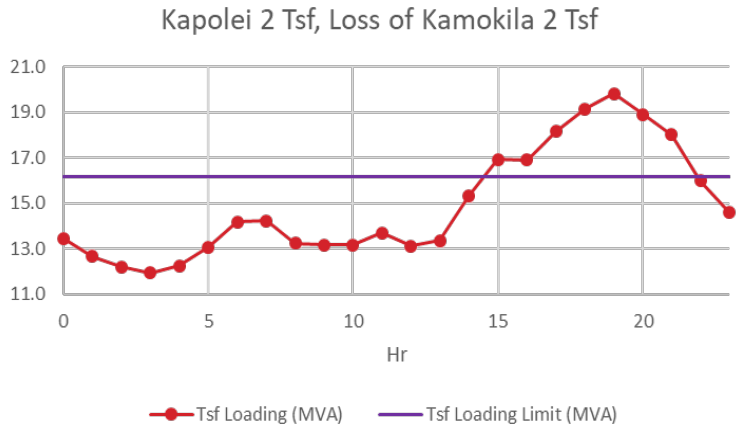
- Tsf/Ckt 24-Hr Loading Waveform of the Worst Scenario, from 2022 to 2024
  - **2022**, Contingency Condition

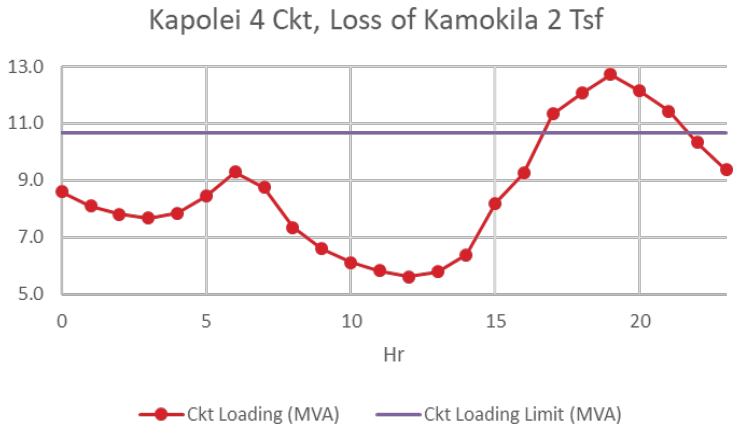




East Kapolei Area Review

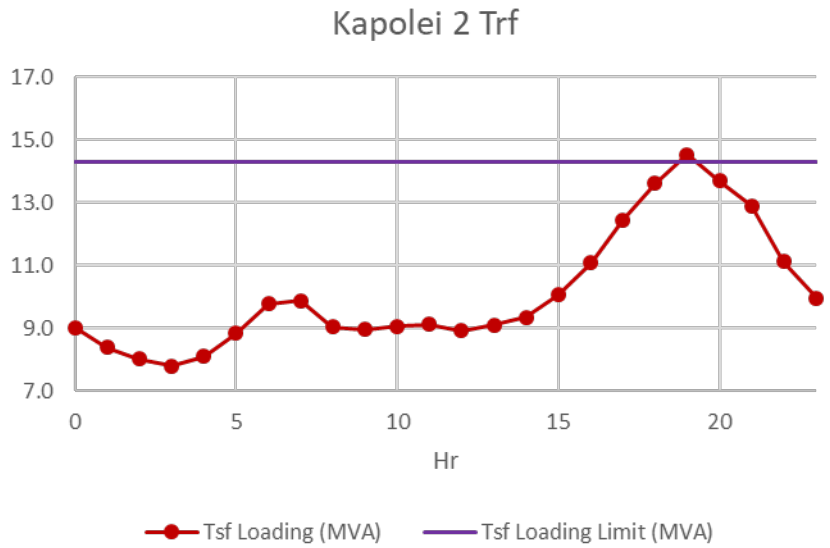
- Tsf/Ckt 24-Hr Loading Waveform of the Worst Scenario, from 2022 to 2024
  - **2023**, Contingency Condition





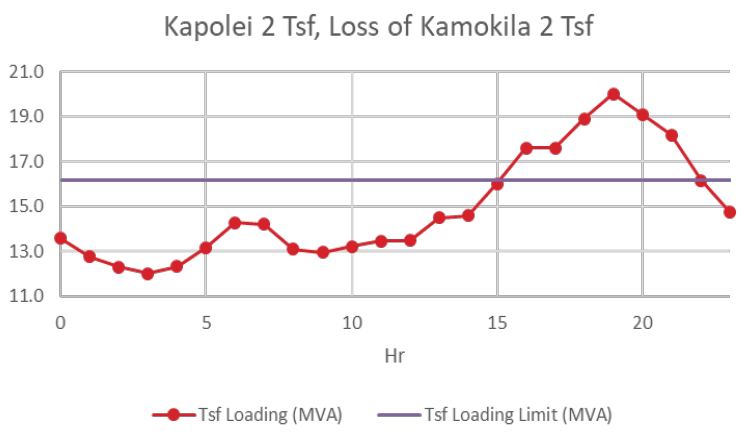
East Kapolei Area Review

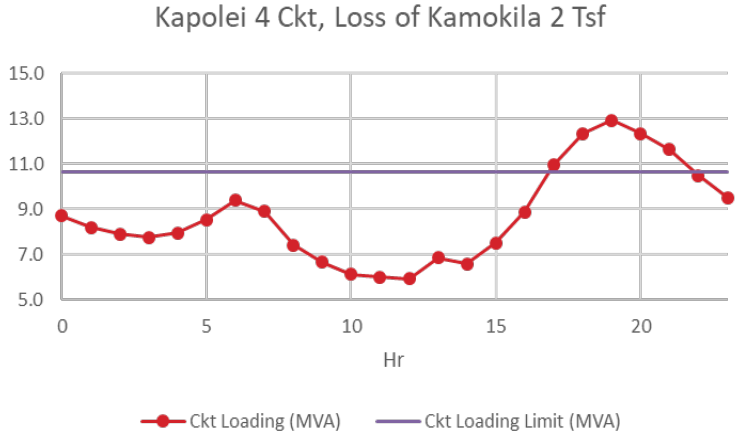
- Tsf/Ckt 24-Hr Loading Waveform of the Worst Scenario, from 2022 to 2024
  - **2024**, Normal Condition



East Kapolei Area Review

- Tsf/Ckt 24-Hr Loading Waveform of the Worst Scenario, from 2022 to 2024
  - **2024**, Contingency Condition





East Kapolei Area Review

- Tsf/Ckt 24-Hr Loading Waveform of the Worst Scenario, from 2019 to 2025
  - Summary of Observation

Normal Condition	Year			
	2022	2023	2024	2025
# of Tsf Overloaded	0	0	1	1
Max Overloaded MVA on Tsf	0	0	0.2	0.1
Longest Overloaded Duration (Hr) on Tsf in a Day	0	0	1	1
Max. Overloaded MWH on Tsf in a Day	0	0	0.2	0.1
# of Ckt Overloaded	0	0	0	0
Max Overloaded MVA on Ckt	0	0	0	0
Longest Overloaded Duration (Hr) on Ckt in a Day	0	0	0	0
Max. Overloaded MWH on Ckt in a Day	0	0	0	0

Contingency Condition	Year			
	2022	2023	2024	2025
# of Tsf Overloaded	1	1	1	1
Max Overloaded MVA on Tsf	2.3	3.6	3.9	3.7
Longest Overloaded Duration (Hr) on Tsf in a Day	5	9	9	9
Max. Overloaded MWH on Tsf in a Day	5.8	14.8	15.9	14.6
# of Ckt Overloaded	1	1	1	1
Max Overloaded MVA on Ckt	0.8	2.1	2.3	2.2
Longest Overloaded Duration (Hr) on Ckt in a Day	3	6	6	6
Max. Overloaded MWH on Ckt in a Day	1.4	6	6.5	6.7

East Kapolei Area Review – Summary Forecast of Capacity Needs

- Potential capacity needs on Kapolei 2 Tsf and Kapolei 4 Ckt or portion of Kamokila 2 Tsf and Kamokila 4 Ckt

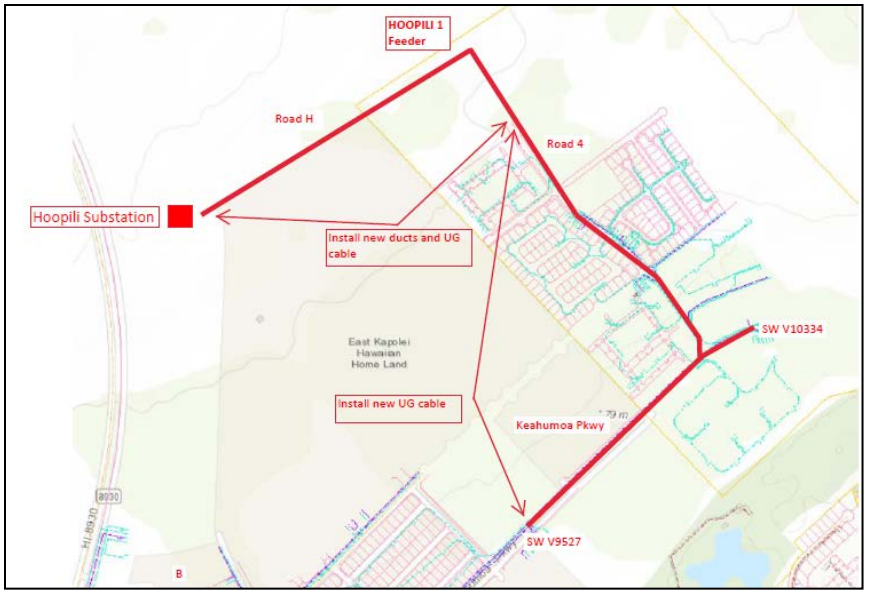
Year	Capacity (MVA)	Delivery Months	Delivery Hours	# of days per year
2022	2.3	Apr. - Dec.	4PM - 10PM	246
2023	3.6	Jan. - Dec.	4PM - 9PM	365
2024	3.9	Jan. - Dec.	4PM - 9PM	366
2025	3.7	Jan. - Dec.	4PM - 9PM	365

* Initial RFP will focus on expected load growth starting in 2022 and may involve a second RFP to meet additional needs as the load materializes.

Distribution Capacity Deferral Opportunity

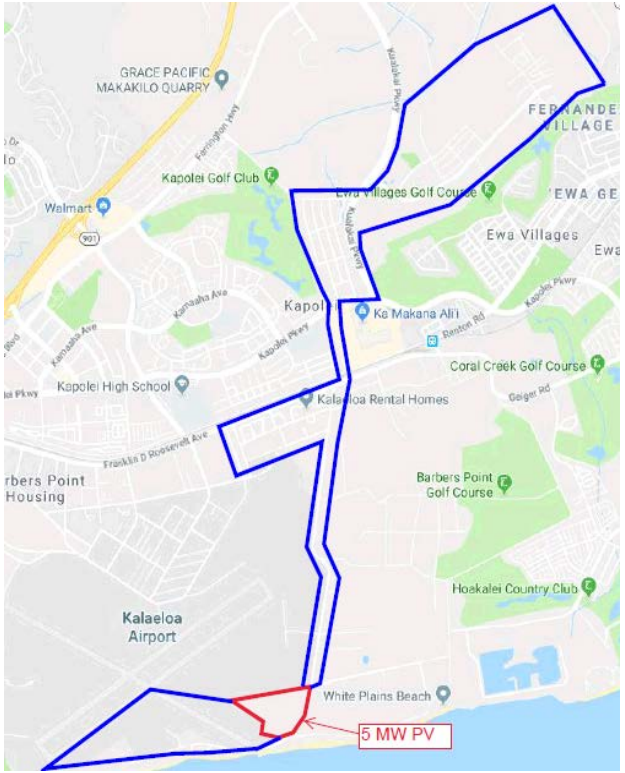
East Kapolei Area Review – Wires Solution

- Wires Solution
  - Approximate 1 mile underground circuit line and ducts extension into the East Kapolei area for additional circuit capacity



East Kapolei NWA Opportunity - Circuit Information

Equipment	Existing PV (MW)	Forecasted PV in 2025 (MW)	Residential Customer count	Commercial Customer count
Kapolei 2 Tsf	6.3	8.0	891	279
Kapolei 4 Ckt	6.3	8.0	891	165
Portion of Kamokila 4 Ckt	2.8	3.9	1954	210



Hawaiian Electric
Maui Electric
Hawai'i Electric Light

Deferment Value Illustration

- Deferment benefit is the “avoided cost” defined as the utility’s annual revenue requirement for the utility’s T&D “wires” alternative.
- Total deferment benefit is based on deferring the investment (i.e., associated revenue requirement) for a period of time.
- Simplified example:
  - “Wires” alternative conceptual capital investment cost in the range of $5.5 to $6.5 million
  - Cost of Capital: 10%
  - Deferment period is 4 years
  - Annual deferment value: approx. $600,000
  - Total deferment value over 4 years: approx. $2.4 million

This information is indicative only to provide some context on the economics of the opportunity. The actual avoided cost will be subsequently determined as one input for proposal evaluation.

Soft Launch NWA Solution Considerations

- Aggregations of DER or standalone resources
- Solutions can be ahead-of-the-meter and/or behind-the-meter
  - Behind-the-meter DER must have an executed Interconnection Agreement
- DER must be located within and interconnected to the eligible circuit(s)
- Proposed DER for Soft Launch demo must be incremental to existing programs, tariffs, or PPAs
    - Completely new asset or add-on to an existing asset
    - Existing assets compensated under an existing program like NEM or under a grid services procurement will not be eligible
- To manage complexity and risk consideration of a minimum size and provider diversity may be needed

Anticipated Soft Launch Learnings

- NWA opportunity and solution parameters/criteria to enable successful proposals that provide operational effectiveness.
- NWA evaluation considerations, beyond price (in relation to avoided cost)
- Insights on operational risks and factors such as NWA reserve margins
- Information exchange needed

Next Steps

- Determination of what will be solicited.
- Complete development of initial RFP draft for circulation and input.
- Host Pre-bidders discussion. Scheduled for May 21.


Questions & Feedback