Hawai'i Powered

Integrated Grid Plan

Preferred Plans and Next Steps

Hawaiian Electric

2023

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Contents

1 Executive Summary

Hawaiian Electric provides this Supplemental Integrated Grid Plan Report ("supplemental report") in response to Order No. 40311 and to provide additional updates since the filing of the May 2023 Integrated Grid Plan.

On October 12, 2023, the Public Utilities Commission issued Order No. 40311 ("Order 40311") directing Hawaiian Electric to further explain and clarify its near- and long-term preferred plans for generation and capacity in its Integrated Grid Plan. Specifically, the Public Utilities Commission stated:

> *Hawaiian Electric shall file a revised Plan that clearly identifies its preferred plan for each of its service territories, including both the expected "resource generation mix" and planned "resource installed capacity mix" in 2030, 2035, 2040 and 2045. Hawaiian Electric's preferred plans shall include pie graphs showing the percentage of each resource technology at each milestone for each service territory and must accurately integrate the pending/planned resources that remain viable from RFPs 1, 2, and 3, and CBRE, in addition to the proxy resources identified through the IGP modeling process. Hawaiian Electric may use additional visualization methods to clearly convey the preferred plans for each of its service territories in 2030, 2035, 2040, and 2045. Hawaiian Electric must present only one preferred plan per service territory (i.e., not a preferred base plan for Oahu and a preferred land-constrained plan). If Hawaiian Electric wants to present more than one plan, it should select its preferred plan and describe others as alternatives.* [1]

On October 19, 2023, we held a Stakeholder Technical Working Group meeting to discuss the method, analysis and thought process in developing the Preferred Plans.[2] In that meeting, we presented to stakeholders how the results of the various planning analyses were used to inform the Preferred Plans including any changes in size, timing or costs of resources from the initial resource plans developed in RESOLVE.

This supplemental report provides additional clarity on the Preferred Plan for each island (and an alternative plan for O'ahu), clearly differentiating planned resources that have been selected either through a procurement or a signed power purchase agreement from future renewable resources that were identified in the Integrated Grid Plan analysis. This supplemental report references and supplements the Integrated Grid Plan, including, Sections 8, 11, 12 and Appendix C.

The devastating wildfires on Maui in August 2023 have not changed the Preferred Plans. However, they have impacted the Integrated Grid Plan timeline, as helping the Maui community recover and rebuild remains our top priority. The updated schedule, as discussed in Section 1.1, provides stakeholders further opportunities to ensure the design of the procurements incorporates equity

[1] Order 40311 at 4-5 (footnotes omitted).

[2] Meeting slides and summary notes for the October 19 STWG meeting can be found at https://www.hawaiianelectric.com/clean-energy-hawaii/integrated-grid-planning/stakeholder-and-community-engagement/working-groups/stakeholder-technical-documents

considerations[3] and requirements intended to keep our communities safe. For example, this includes determining the extent and location of renewable energy zones and associated transmission infrastructure, requirements to ensure generation facilities and independent power producers are made as resilient as possible, implementation of community benefits packages and allowing communities to provide input on siting future energy infrastructure.

As intended at the outset of the Integrated Grid Plan process, the plans are a living roadmap with the flexibility to adapt to the changing planning environment and market conditions through adding new procurements and programs to the underlying analytical models. The urgency with which we must execute our plans remains unchanged to meet our 2030 and 2035 goals and accomplish the following actions over the next 5+ years:

- Stabilize utility rates and advance energy equity
- Grow the marketplace for customer-scale and large-scale renewables
- Create a modern and resilient grid
- Secure reliability though diverse energy sources and technologies

An updated version of the proposed timeline for the addition/retirement of resources provided in the Integrated Grid Plan is shown below in Figure 1-1. Changes to this figure reflect:

- Identifying the O'ahu land-constrained scenario as the Preferred Plan for O'ahu instead of the O'ahu base scenario
- Changes to specific requests for proposals ("RFPs") or programs because a project withdrew from the RFP or the program adoption was less than the target

Note that the Stage 3 RFP project selection process is still underway. Finalizing the Stage 3 selected portfolio will impact targets for future procurements.

[3] *See* Order No. 40290 issued on September 27, 2023 in Docket No. 2022-0250, Setting Next Steps for the Equity Docket.

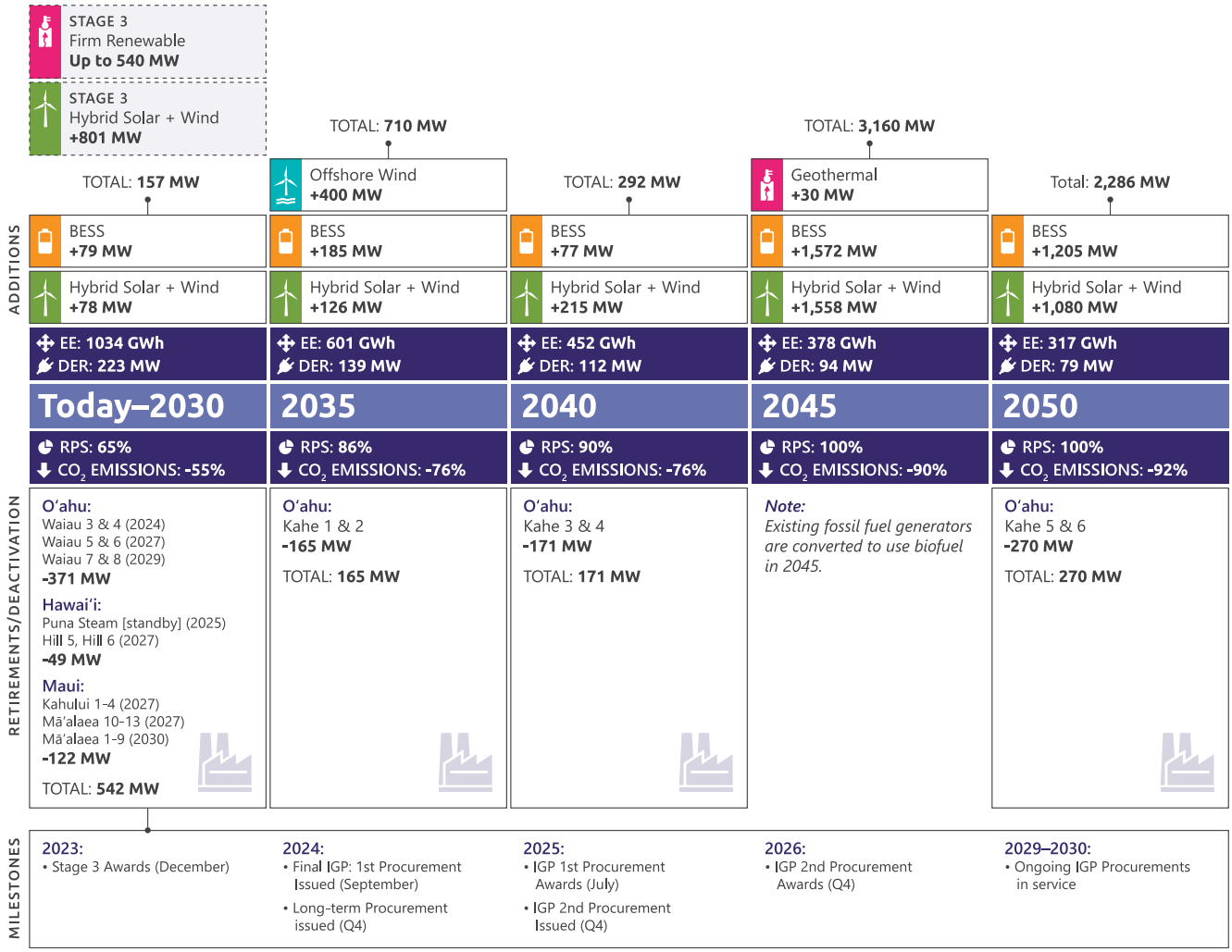

Figure 1-1. Proposed timeline of adding renewable resources, retiring or deactivating fossil fuel–based generation and reducing carbon emissions

Approval of the Integrated Grid Plan provides guidance for renewable energy integration, reliability and resilience. This would allow for a common starting point for many dockets and proceedings that are needed to support the Preferred Plan outcomes. A strong and financially healthy utility will be critical to successful implementation. This was extensively discussed in the Performance Based Regulation proceeding, Docket No. 2018-0088.

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2 Preferred Plans

The following sections provide each island's Preferred Plan, identifying resources acquired through the Stage 1, Stage 2, Stage 3 and community-based renewable energy ("CBRE") procurements.

Future resources were selected as part of the capacity planning optimization. The Preferred Plans are a result of adjustments made to the Base Plan (selected through the capacity expansion optimization step) and further iterated through the planning process (Figure 2-1) including transmission and system security needs, resource adequacy and distribution needs analyses. These Base Plan adjustments to arrive at the Preferred Plan are noted in Tables C-16, C-18, C-21, C-24, C-27, C-30 of Appendix C in the Integrated Grid Plan.

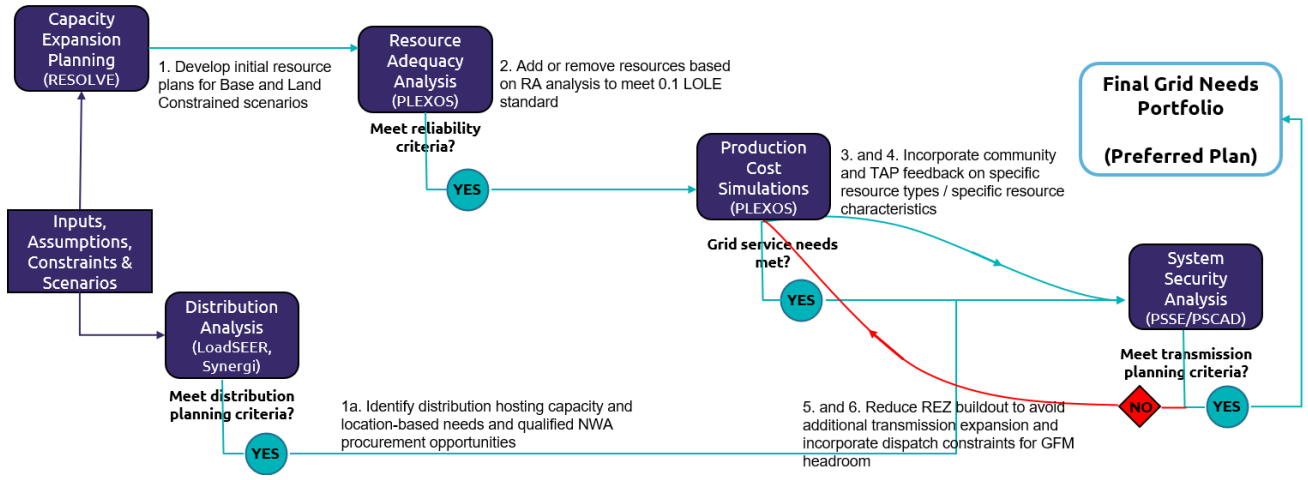

Figure 2-1. Integrated Grid Plan process flow

The Integrated Grid Plan process allows for flexibility to adapt as market conditions and the planning environment change. For example, if a change in state policy allows for rapid development of renewable energy projects and transmission infrastructure, then future procurements will target future solar identified in the Base Preferred Plan. Consistent with the Public Utilities Commission guidance in Order 40311, the pie and stacked area charts in this section provide the capacity and energy for the resources in the Preferred Plans. They also distinguish between planned resources from the Stage 1 and Stage 2 RFPs and CBRE program from future resources selected through the modeling process. No adjustment was made to the Stage 3 RFP resource as the final award group for that RFP has not yet been announced.

In instances where the modeled placeholder resource for a specific RFP or program was different than the actual projects because a project withdrew from the RFP or the program

adoption was less than the target, the remaining capacity and energy to meet the RFP or program target was moved to the "future solar" category. The modeled CBRE resource was adjusted to only include the projects listed in the renewable project status board[4] and projects that are already in service. Modeled capacity for the CBRE small projects was also removed as no projects enrolled in the small project CBRE program.

Table 2-1 shows the planned and in-service CBRE projects on Hawai'i Island, Lāna'i, Maui, Moloka'i, and O'ahu.

Table 2-1. Planned and In-Service CBRE Projects

Name	Island	Size
Ka Lae Solar	Hawai'i Island	0.5 MW
Ka Lae 2 Solar	Hawai'i Island	0.5 MW
Kalaoa Solar A	Hawai'i Island	3 MW, 12 MWh (BESS)
Kalaoa Solar B	Hawai'i Island	3 MW, 12 MWh (BESS)
Nā'ālehu Solar	Hawai'i Island	3 MW, 12 MWh (BESS)
South Point	Hawai'i Island	0.75 MW
Lāna'i Solar	Lāna'i	17.5MW, 89 MWh (BESS)
Lipoa Solar	Maui	3 MW, 12 MWh (BESS)
Makawao Solar	Maui	2.5 MW, 10 MWh (BESS)
Pi'iholo Road Solar	Maui	2.5 MW, 10 MWh (BESS)
ROIZ	Maui	0.03 MW
Kualapu'u Community Based Renewable Energy	Moloka'i	0.25 MW, 1 MWh (BESS)
Pālā'au Community Based Renewable Energy	Moloka'i	2.2 MW, 10 MWh (BESS)
Kaukonahua Solar	O'ahu	6 MW
Savio Solar Mā'ili	O'ahu	8 MW, 32 MWh (BESS)
Mililani Tech Solar	O'ahu	0.3 MW
Palailai Solar	O'ahu	3 MW
Kalaeloa Home Lands Solar[5]	O'ahu	1.7 MW

In addition to the change in CBRE resource, changes were made to the Stage 2 RFP resource where the Kamaole Solar project on Maui was removed. Table 2-2 shows the planned and in-service Stage 1 and Stage 2 RFP projects on Hawai'i Island, Maui and O'ahu.

Table 2-2. Planned and In-Service Stage 1 and Stage 2 RFP Projects

Name	Island	Size
Hale Kuawehi Solar	Hawai'i Island	30 MW, 120 MWh (BESS)
AES Waikoloa Solar	Hawai'i Island	30 MW, 120 MWh (BESS)
AES Kuihelani	Maui	60 MW, 240 MWh (BESS)
Paeahu Solar	Maui	15 MW, 60 MWh (BESS)
AES West Oahu Solar	O'ahu	12.5 MW, 50 MWh (BESS)
Ho'ohana Solar 1	O'ahu	52 MW, 208 MWh (BESS)
Kapolei Energy Storage	O'ahu	185 MW, 565 MWh
Kūpono Solar	O'ahu	42 MW, 168 MWh (BESS)
Mountain View Solar	O'ahu	7 MW, 35 MWh (BESS)
Waiawa Phase 2 Solar	O'ahu	30 MW, 240 MWh (BESS)
Mililani I Solar	O'ahu	39 MW, 156 MWh (BESS)
Waiawa Solar	O'ahu	36 MW, 144 MWh (BESS)

[4] *See* https://www.hawaiianelectric.com/clean-energy-hawaii/our-clean-energy-portfolio/renewable-project-status-board

[5] KHLS recently withdrew from the CBRE program on O'ahu but was still included in the Consolidated and O'ahu charts presented in this Supplemental Update.

2.1 O‘ahu

The Integrated Grid Plan provided two preferred plans on O‘ahu: the Base Preferred Plan and the Land-Constrained Preferred Plan. The Base Preferred Plan represents the least-cost plan and assumes that land for energy projects on O‘ahu becomes more available than it is today. The Land-Constrained Preferred Plan represents the least-cost plan in a scenario where the potential for land-based resources is limited due to current land use policies and the balancing of competing state goals for affordable housing, food sustainability and renewable energy.

Given the Public Utilities Commission’s guidance in Order 40311 to present only one preferred plan per service territory, we need a plan that all stakeholders can be accountable to achieve. Several stakeholders acknowledged that the state’s renewable energy and carbon reduction goals are ambitious and questioned the feasibility of achieving the renewable energy targets outlined in our timeline, particularly for O‘ahu, where concerns were raised on implementation, land use and community acceptance.[6] While it is still too early to determine whether the Base Preferred Plan is achievable (i.e., integrating nearly 3,000 MW of solar and storage by 2050), the Land-Constrained Preferred Plan represents a near-term achievable target for 2030. The Base Preferred Plan represents the lowest cost for customers over the longer-term (beyond 2035), which we must all continue to strive for—however, uncertainties in policy, community and market constraints need to be resolved for it to become achievable.[7]

Recognizing this feedback, Hawaiian Electric proposes that the Land-Constrained Plan be the Preferred Plan for O‘ahu through 2035, which would achieve an O‘ahu Renewable Portfolio Standard (“RPS”) of 55% by 2030 and 83% by 2035. The difference in RPS achievement compared to the Base Preferred Plan is equivalent to an approximate 5-year delay in achieving the same level of RPS in 2030 for the Base Preferred Plan. The benefit of this path forward is that it would allow communities and stakeholders the time to develop long-term solutions identified in the Equity Docket,[8] incorporate any additional resilience requirements and work toward necessary policy changes needed to achieve the Base Plan.

The charts below illustrate how the O‘ahu Preferred Plan resource mix changes over time in terms of capacity and energy. Along with resource type, the resource mix is also divided into existing, planned (Stage 1 RFP, Stage 2 RFP, Stage 3 RFP, CBRE program) and future resources consistent with the Public Utilities Commission guidance provided in Order 40311. Any adjusted capacity to account for modeled projects that have withdrawn or program targets that have not been fulfilled are reported as a future solar resource along with other future solar that was selected through Integrated Grid Plan modeling.

[6] Multiple stakeholders provided similar comments on the O‘ahu Preferred Plan which were tabulated in Appendix H: Comments on Draft IGP Report.

[7] Developer responses to procurements in future Integrated Grid Plan cycles would provide greater clarity on the amount of land that is available for renewable energy development. Some of the factors that were discussed along with energy stakeholders include, but are not limited to: current market pricing, lack of developable parcels of land next to existing infrastructure, community concerns with the amount of land and the location of future renewable projects and the need to develop renewable energy zones in an equitable way in collaboration with communities and in a safe and resilient manner.

[8] *See* Order 40290 at 11.

Figure 2-2 shows the generation by resource type in key years over the planning horizon for the O'ahu Preferred Plan.

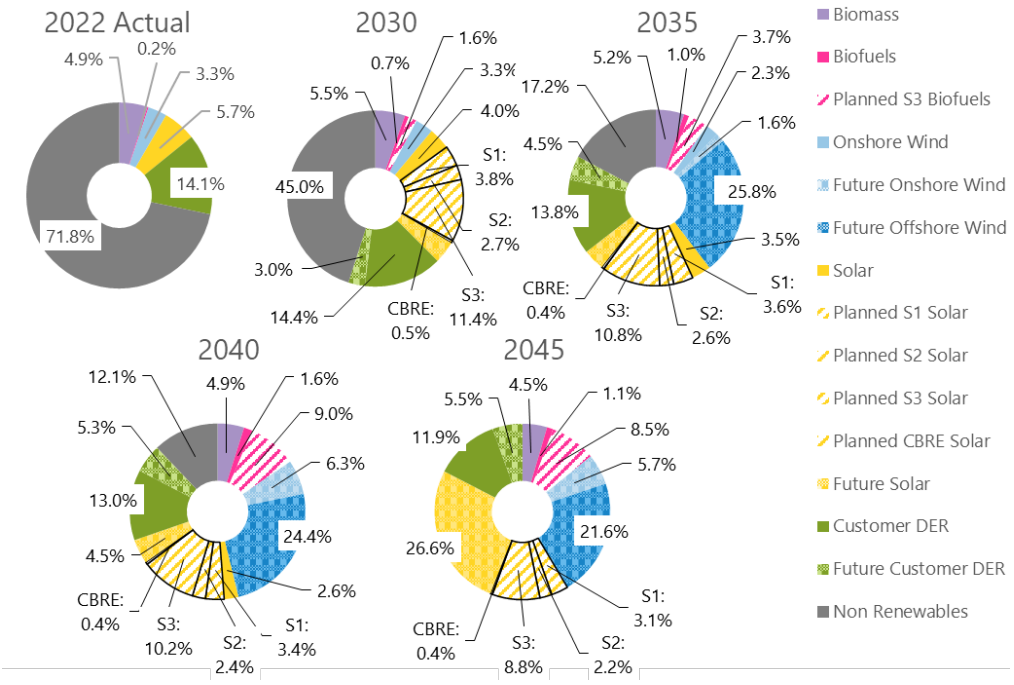

Figure 2-2. Preferred plan generation mix: O'ahu

Figure 2-3 shows the change in capacity over time for the O'ahu Preferred Plan.

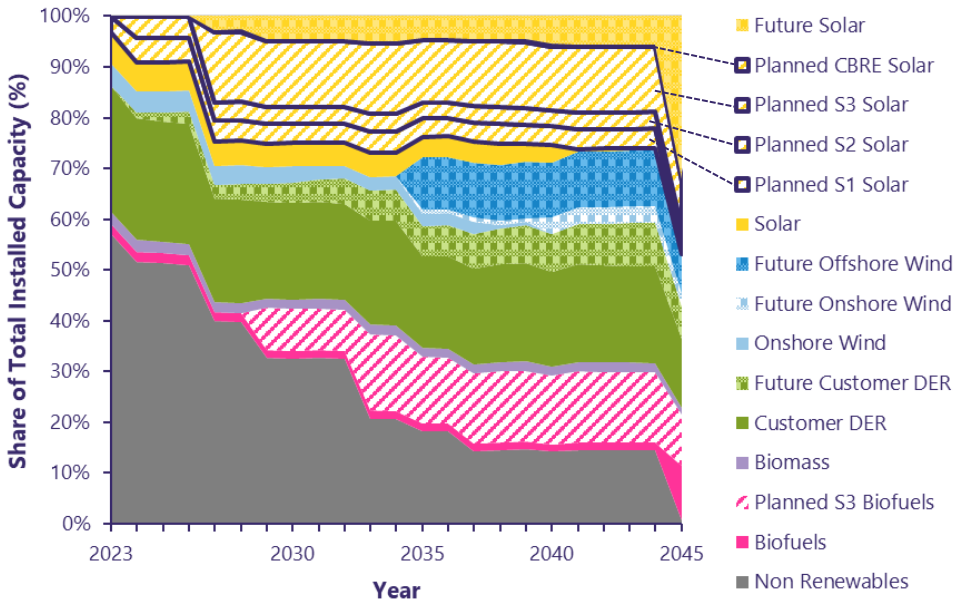

Figure 2-3. O'ahu: Preferred Plan installed capacity mix (2023–2045)

Figure 2-4 shows the change in generation over time for the O'ahu Preferred Plan.

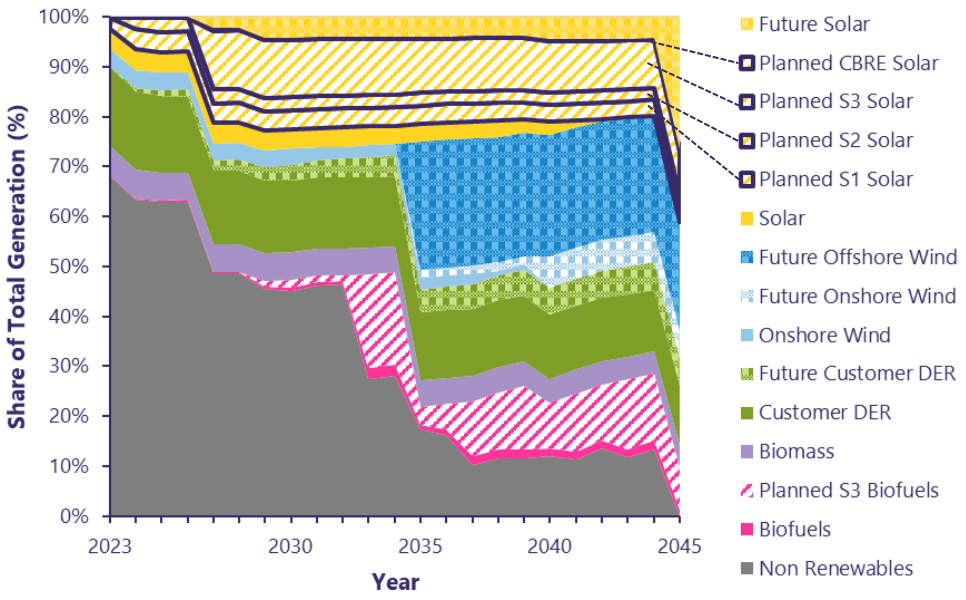

Figure 2-4. O'ahu: Preferred Plan generation mix (2023–2045)

Figure 2-5 shows the incremental change in capacity for the O'ahu Preferred Plan. For future solar and wind additions, the future capacity includes existing independent power producers that may be repowered after the expiration of their power purchase agreement.

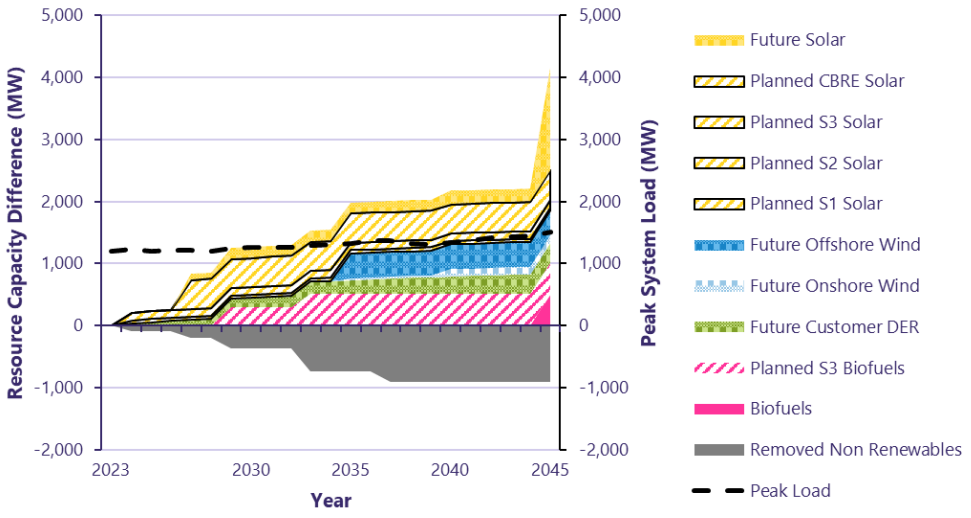

Figure 2-5. O'ahu: Preferred Plan change in installed capacity by resource type (2023–2045)

The charts below illustrate the capacity and energy of resources in the O'ahu Preferred Plan. Because the future solar category is now broken out by individual resource, any adjusted capacity to account for modeled projects that have withdrawn or program targets that have not been fulfilled are reported in the "deferred solar" category. Other future solar that was selected through the Integrated Grid Plan modeling is named separately. In the O'ahu Preferred Plan, because the future development of solar was limited to the land-constrained scenario, no further future solar resources are named.

Figure 2-6 shows the installed capacity by resource in year 2030 for the O'ahu Preferred Plan.

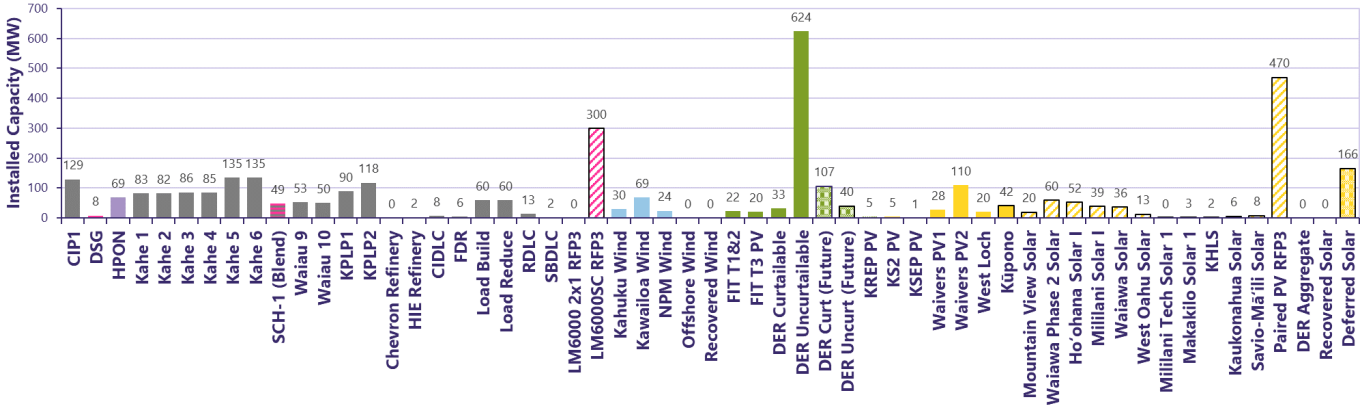

Figure 2-6. O'ahu: Preferred Plan installed capacity by resource (2030)

Figure 2-7 shows the installed capacity by resource in year 2035 for the O'ahu Preferred Plan.

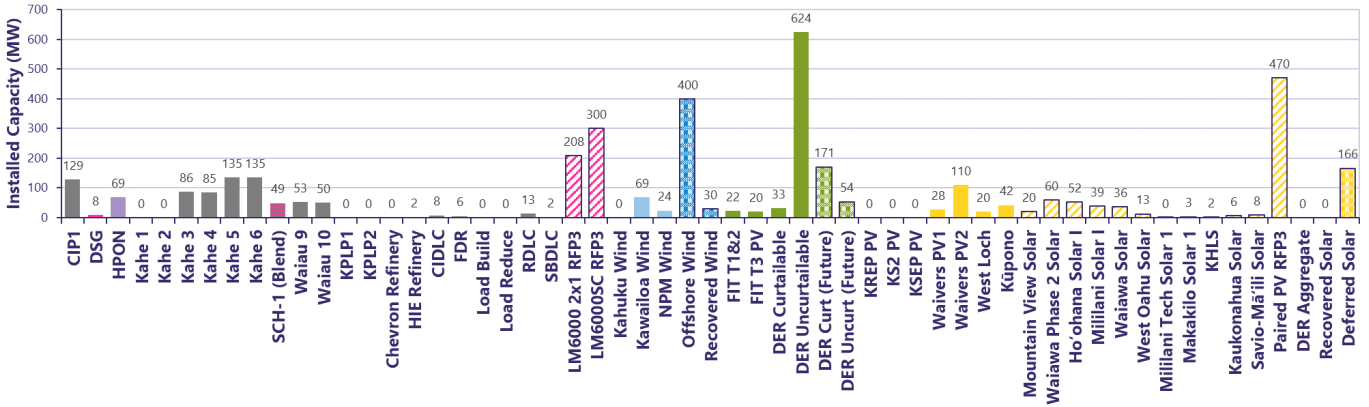

Figure 2-7. O'ahu: Preferred Plan installed capacity by resource (2035)

Figure 2-8 shows the installed capacity by resource in year 2040 for the O'ahu Preferred Plan.

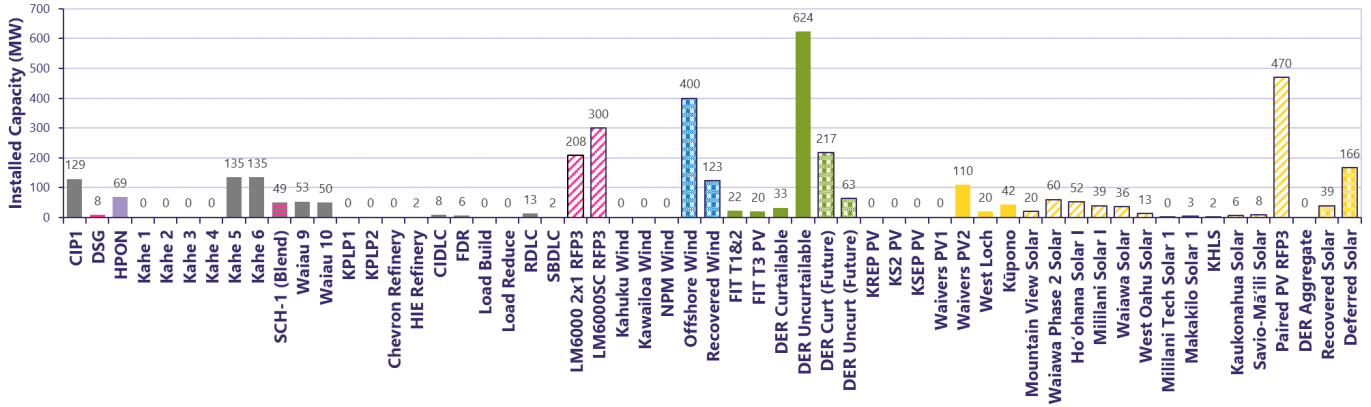

Figure 2-8. O'ahu: Preferred Plan installed capacity by resource (2040)

Figure 2-9 shows the installed capacity by resource in year 2045 for the O'ahu Preferred Plan.

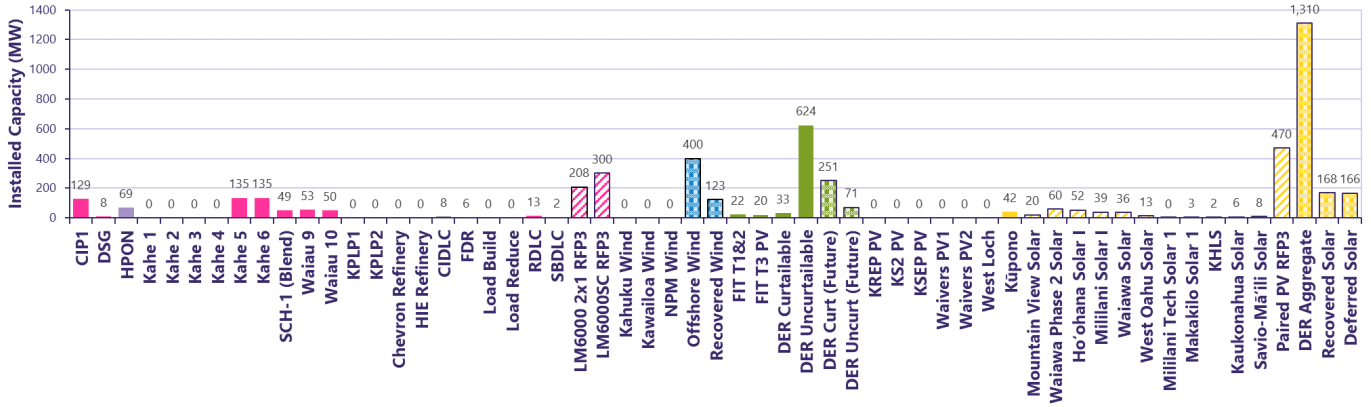

Figure 2-9. O'ahu: Preferred Plan installed capacity by resource (2045)

Figure 2-10 shows the generation by resource in year 2030 for the O'ahu Preferred Plan.

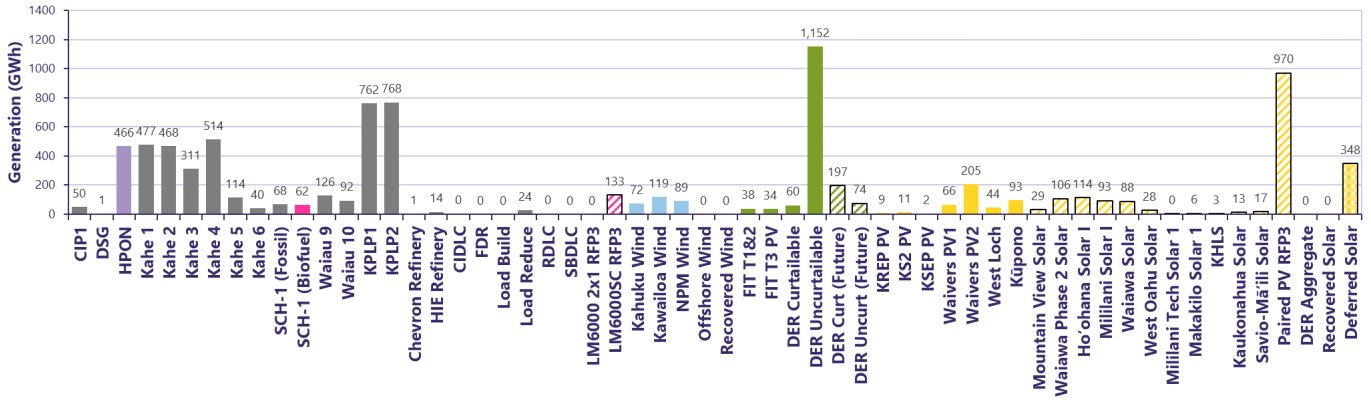

Figure 2-10. O'ahu: Preferred Plan generation by resource (2030)

Figure 2-11 shows the generation by resource in year 2035 for the O'ahu Preferred Plan.

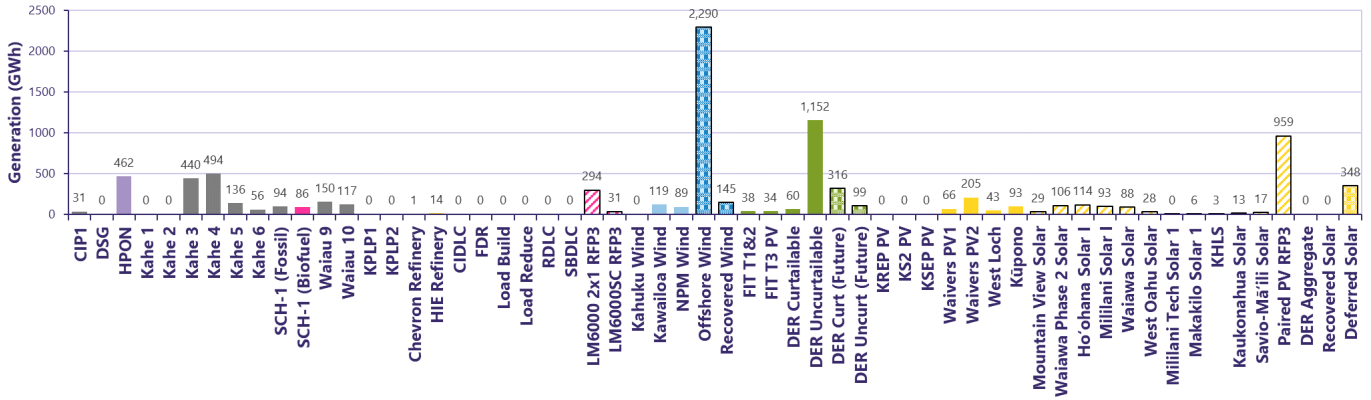

Figure 2-11. O'ahu: Preferred Plan generation by resource (2035)

Figure 2-12 shows the generation by resource in year 2040 for the O'ahu Preferred Plan.

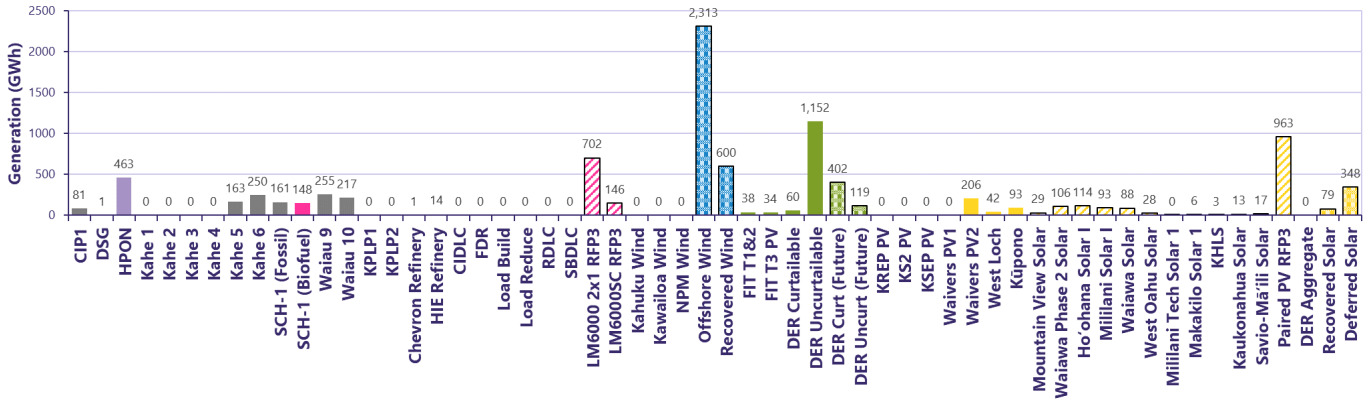

Figure 2-12. O'ahu: Preferred Plan generation by resource (2040)

Figure 2-13 shows the generation by resource in year 2045 for the O'ahu Preferred Plan.

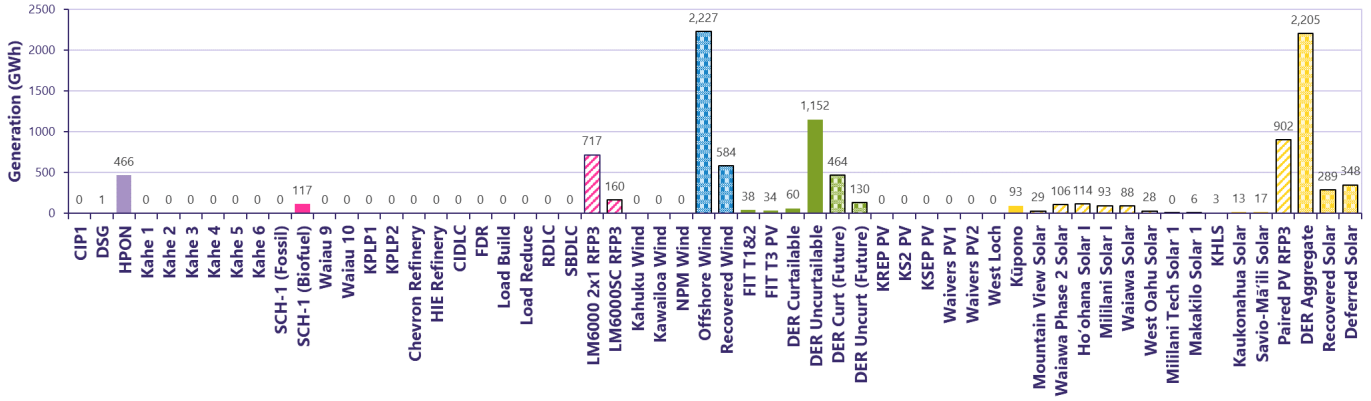

Figure 2-13. O'ahu: Preferred Plan generation by resource (2045)

Table 2-3 summarizes the installed capacity and generation for each resource in the O'ahu Preferred Plan portfolio shown in the preceding figures. Each resource is accompanied by their full name or a brief description of the resource. Generators running on fossil fuel/biofuel blends have their generation proportionally split between non-renewable and renewable sources. In years where the installed capacity and generation are shown as zero, existing fossil fuel resources may be deactivated or their power purchase agreement expired.

Table 2-3. O'ahu: Preferred Plan installed capacity and generation by resource (2030, 2035, 2040, 2045)

Resource	Full Name / Description	Category	Installed Capacity (MW)				Generation (GWh)			
			2030	2035	2040	2045	2030	2035	2040	2045
CIP1	Campbell Industrial Park	Non-Renewables	129.0	129.0	129.0	129.0	49.6	30.9	81.1	0.1
DSG	Airport Emergency Power Facility	Biofuels	8.0	8.0	8.0	8.0	0.6	0.3	1.3	0.5
HPON	H-Power	Biomass	68.5	68.5	68.5	68.5	466.0	462.1	463.4	466.0
Kahe 1	Kahe 1	Non-Renewables	82.6	0.0	0.0	0.0	477.3	0.0	0.0	0.0
Kahe 2	Kahe 2	Non-Renewables	82.4	0.0	0.0	0.0	467.7	0.0	0.0	0.0
Kahe 3	Kahe 3	Non-Renewables	86.1	86.1	0.0	0.0	310.5	440.0	0.0	0.0
Kahe 4	Kahe 4	Non-Renewables	85.4	85.4	0.0	0.0	514.1	493.9	0.0	0.0
Kahe 5	Kahe 5	Non-Renewables	134.9	134.9	134.9	134.9	114.3	135.7	162.6	0.0
Kahe 6	Kahe 6	Non-Renewables	134.7	134.7	134.7	134.7	40.3	55.8	249.9	0.0
SCH-1 (Fossil)	Schofield (Fossil fuel portion of fuel blend)	Non-Renewables	48.8	48.8	48.8	48.8	67.6	93.6	161.5	0.0
SCH-1 (Biofuel)	Schofield (Biofuel portion of fuel blend)	Non-Renewables	48.8	48.8	48.8	48.8	61.9	85.7	147.9	116.7
Waiau 9	Waiau 9	Non-Renewables	52.9	52.9	52.9	52.9	126.4	149.5	255.5	0.0
Waiau 10	Waiau 10	Non-Renewables	49.9	49.9	49.9	49.9	92.0	117.1	217.1	0.0
KPLP1	Kalaeloa Partners 1	Non-Renewables	90.0	0.0	0.0	0.0	762.4	0.0	0.0	0.0
KPLP2	Kalaeloa Partners 2	Non-Renewables	118.0	0.0	0.0	0.0	767.6	0.0	0.0	0.0
Chevron Refinery	Chevron Refinery	Non-Renewables	0.1	0.1	0.1	0.0	0.9	0.9	0.9	0.0
HIE Refinery	HIE Refinery	Non-Renewables	1.7	1.7	1.7	0.0	14.4	14.4	14.5	0.0
CIDLC	Commercial Industrial Direct Load Control	Non-Renewables	7.8	7.8	7.8	7.8	0.1	0.1	0.1	0.1
FDR	Fast Demand Response	Non-Renewables	5.5	5.5	5.5	5.5	0.1	0.1	0.1	0.1
Load Build	Load Build	Non-Renewables	60.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Load Reduce	Load Reduce	Non-Renewables	60.0	0.0	0.0	0.0	24.4	0.0	0.0	0.0
RDLC	Residential Direct Load Control	Non-Renewables	13.2	13.2	13.2	13.2	0.3	0.3	0.3	0.3
SBDLC	Small Business Direct Load Control	Non-Renewables	1.6	1.6	1.6	1.6	0.0	0.0	0.0	0.0
LM6000 2x1 RFP3	Stage 3 RFP Proxy Firm Resource	Planned S3 Biofuels	0.0	208.0	208.0	208.0	0.0	293.9	702.5	716.7
LM6000SC RFP3	Stage 3 RFP Proxy Firm Resource	Planned S3 Biofuels	300.0	300.0	300.0	300.0	132.5	31.1	146.2	160.4
Kahuku Wind	Kahuku Wind	Onshore Wind	30.0	0.0	0.0	0.0	71.6	0.0	0.0	0.0
Kawailoa Wind	Kawailoa Wind	Onshore Wind	69.0	69.0	0.0	0.0	119.1	119.1	0.0	0.0
NPM Wind	Nā Pua Makani Wind	Onshore Wind	24.0	24.0	0.0	0.0	89.5	89.5	0.0	0.0

Resource	Full Name / Description	Category	Installed Capacity (MW)				Generation (GWh)			
			2030	2035	2040	2045	2030	2035	2040	2045
Offshore Wind	Future Offshore Wind Candidate Resource	Future Offshore Wind	0.0	400.0	400.0	400.0	0.0	2290.4	2312.7	2227.2
Recovered Wind	Renewed Wind PPAs	Future Offshore Wind	0.0	30.0	123.0	123.0	0.0	144.5	599.9	583.5
FIT T1&2	FIT Tier 1 and 2	Customer DER	22.3	22.3	22.3	22.3	37.8	37.8	37.8	37.8
FIT T3 PV	FIT Tier 3	Customer DER	20.0	20.0	20.0	20.0	33.8	33.8	33.8	33.8
DER Curtailable	Curtailable DER (2023 Levels)	Customer DER	32.6	32.6	32.6	32.6	60.1	60.1	60.1	60.1
DER Uncurtailable	Uncurtailable DER (2023 Levels)	Customer DER	623.7	623.7	623.7	623.7	1151.6	1151.6	1151.6	1151.6
DER Curt (Future)	Curtailable DER (above 2023 Levels)	Future Customer DER	106.6	170.9	217.3	251.3	196.9	315.6	402.1	464.1
DER Uncurt (Future)	Uncurtailable DER (above 2023 Levels)	Future Customer DER	39.9	53.8	63.0	70.6	73.6	99.3	118.8	130.3
KREP PV	Kalaeloa Renewable Energy Park	Solar	5.0	0.0	0.0	0.0	9.0	0.0	0.0	0.0
KS2 PV	Kalaeloa Solar 2	Solar	5.0	0.0	0.0	0.0	11.3	0.0	0.0	0.0
KSEP PV	Kapolei Sustainable Energy Park	Solar	1.0	0.0	0.0	0.0	1.9	0.0	0.0	0.0
Waivers PV1	Waianae Solar	Solar	27.6	27.6	0.0	0.0	65.6	65.6	0.0	0.0
Waivers PV2	Kawailoa Solar, Lanikuhana Solar, Waipio Solar	Solar	109.6	109.6	109.6	0.0	205.1	205.1	205.5	0.0
West Loch	West Loch Solar	Solar	20.0	20.0	20.0	0.0	44.3	43.1	41.9	0.0
Kūpono	Kūpono Solar	Planned S2 Solar	42.0	42.0	42.0	42.0	93.3	93.3	93.3	93.3
Mountain View Solar	Mountain View Solar	Planned S2 Solar	19.5	19.5	19.5	19.5	29.0	29.0	29.0	29.0
Waiawa Phase 2 Solar	Waiawa Phase 2 Solar	Planned S2 Solar	60.0	60.0	60.0	60.0	105.8	105.9	105.9	105.9
Hoʻohana Solar I	Hoʻohana Solar I	Planned S1 Solar	52.0	52.0	52.0	52.0	114.5	114.5	114.5	114.5
Mililani Solar I	Mililani Solar I	Planned S1 Solar	39.0	39.0	39.0	39.0	93.1	93.1	93.1	93.1
Waiawa Solar	Waiawa Solar	Planned S1 Solar	36.0	36.0	36.0	36.0	87.9	87.9	87.9	87.9
West Oahu Solar	West Oahu Solar	Planned S1 Solar	12.5	12.5	12.5	12.5	27.6	27.6	27.6	27.6
Mililani Tech Solar 1	Mililani Tech Solar 1	Planned CBRE Solar	0.3	0.3	0.3	0.3	0.5	0.5	0.5	0.5
Makakilo Solar 1	Makakilo / Palailai Solar 1	Planned CBRE Solar	3.0	3.0	3.0	3.0	5.5	5.5	5.6	5.5
KHLS	Kalaeloa Home Lands Solar LLC	Planned CBRE Solar	1.7	1.7	1.7	1.7	3.2	3.2	3.2	3.2
Kaukonahua Solar	Kaukonahua Solar	Planned CBRE Solar	6.0	6.0	6.0	6.0	12.9	12.9	12.9	12.9
Savio-Māʻili Solar	Savio-Māʻili Solar	Planned CBRE Solar	8.1	8.1	8.1	8.1	17.3	17.3	17.3	17.3
Paired PV RFP3	Stage 3 RFP Proxy Solar Resource	Planned S3 Solar	470.0	470.0	470.0	470.0	969.9	958.6	962.7	902.0
DER Aggregate	Uncurtailable DER from Aggregators	Future Solar	0.0	0.0	0.0	1310.0	0.0	0.0	0.0	2204.7
Recovered Solar	Renewed Solar PPAs	Future Solar	0.0	0.0	39.0	168.0	0.0	0.0	79.1	289.0
Deferred Solar	Difference in pre-Stage 3 procurement targets and actual procurements	Future Solar	165.9	165.9	165.9	165.9	347.9	347.9	348.0	347.9

Due to modeled projects that have withdrawn or program targets that have not been fulfilled, approximately 166 MW of additional solar resources are needed to meet O'ahu's Preferred Plan for 2030. This deferred solar capacity is due to CBRE program target shortfalls.

The Stage 3 RFP process is still ongoing and will have a significant impact on whether near-term reliability can be met, depending on the quantity, size, resource type and timing of proposals selected in the final award group, and if those proposals reach commercial operations. By 2030, 300 MW of new firm resources and 450 MW of new hybrid solar resources were assumed to be procured through the Stage 3 RFP. By 2035, an additional 208 MW of new firm resources was assumed to be procured through the Stage 3 RFP.

Figure 2-14 and Figure 2-15 illustrate the capacity and energy by technology that is included in the Preferred Plan.

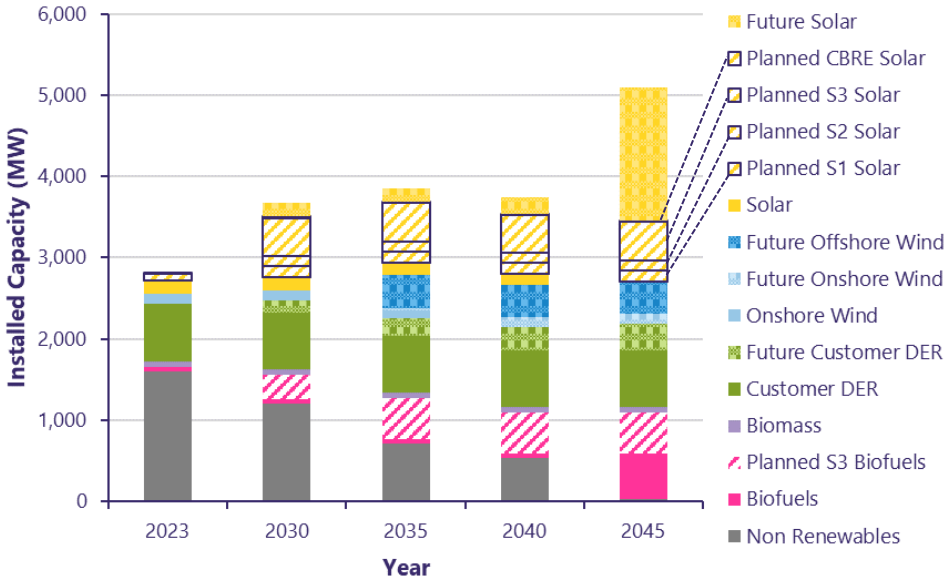

Figure 2-14. O'ahu: Preferred Plan installed capacity by resource type (2023–2045)

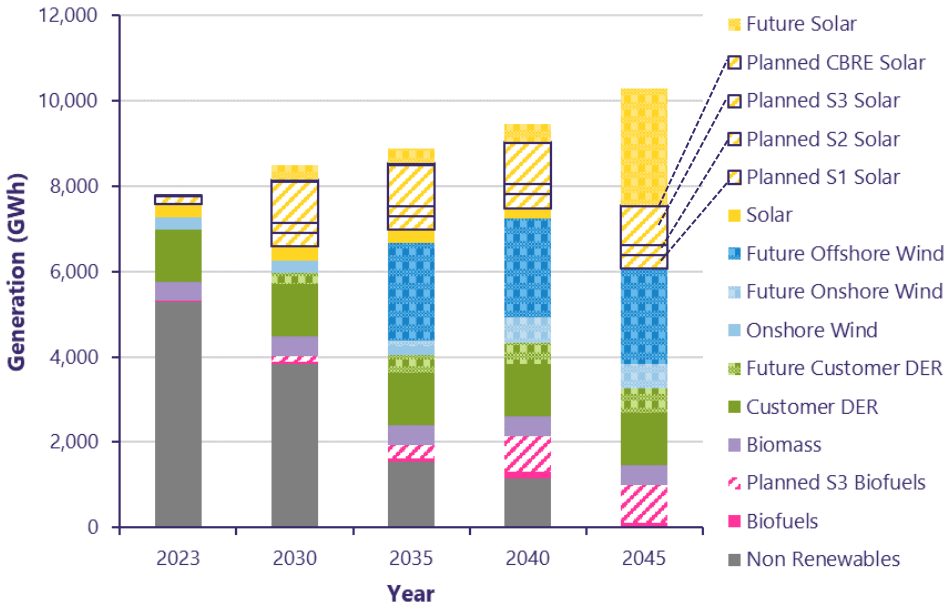

Figure 2-15. O'ahu: Preferred Plan generation by resource type (2023–2045)

O'ahu resource adequacy needs were evaluated under other scenarios in Sections 8.2.2, 12.3.1 and Appendix C to address:

- Higher than expected loads
- Deactivation of more or less existing firm generation depending on the amount of new resources that can be installed in the near term
- Incremental additions of hybrid solar resources
- Incremental additions of firm resources

In Table 12-2 in Section 12.3.1, under the 2030 base load, we show that 1,600 MW of hybrid solar (Stage 3 and future solar) provides a similar reliability benefit as 200 MW of firm and 450 MW of hybrid solar (Stage 3) and both portfolios are able to achieve a loss of load expectation less than 0.1. However, in Table 12-3, we show that in 2035 under a high load, neither 1,600 MW of hybrid solar nor 200 MW of firm and 450 MW of hybrid solar is enough to meet 0.1 loss of load expectation.

In Table 12-3, we also show that under the 2035 base load with limited availability of future solar in a land-constrained scenario, a 0.1 loss of load expectation can be met with the addition of offshore wind. However, under a high load, this same portfolio does not meet a 0.1 loss of load expectation and the delayed deactivation or reactivation of existing firm generators may be needed.

In addition to generation needs, the system security study in Appendix D of the Integrated Grid Plan evaluated O'ahu steady-state and dynamic stability transmission system needs under the land-constrained scenario. This Preferred Plan did not result in finding steady-state needs for transmission network expansion but did include needs for renewable energy zone enablement to interconnect offshore wind through year 2035. From the findings summarized in Appendix D, additional resources may be needed to maintain system stability for voltage and frequency within the transmission planning criteria.

2.1.1 O‘ahu: Alternate Plan

In addition to the O‘ahu Preferred Plan (which is based on the land-constrained scenario), for comparison purposes, we provide an O‘ahu Alternate Plan using a base scenario where land is less limited. The pie and stacked area charts below provide the capacity and energy using the results of the O‘ahu base scenario.

Figure 2-16 shows the generation by resource type in key years over the planning horizon for the O‘ahu Alternate Plan.

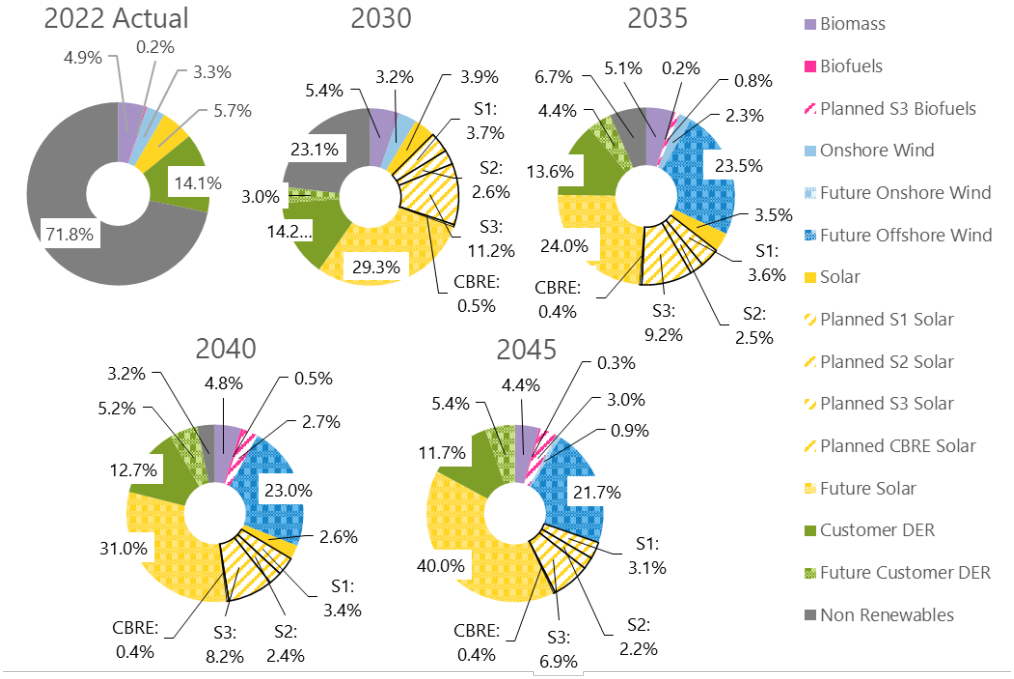

Figure 2-16. Alternate Plan generation mix: O‘ahu

Figure 2-17 shows the change in capacity over time for the O‘ahu Alternate Plan.

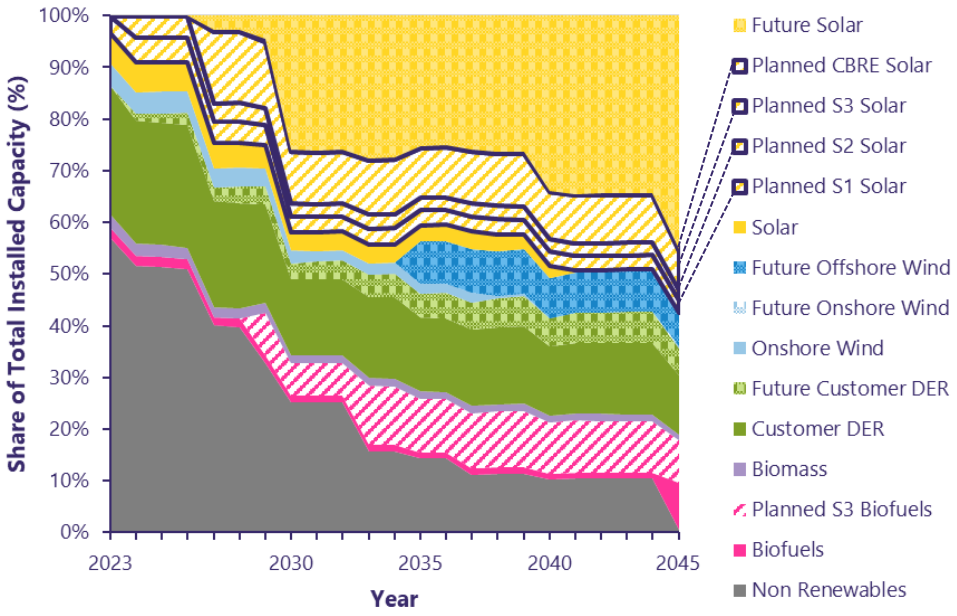

Figure 2-17. O‘ahu: Alternate Plan resource installed capacity mix (2023–2045)

Figure 2-18 shows the change in generation over time for the O'ahu Alternate Plan.

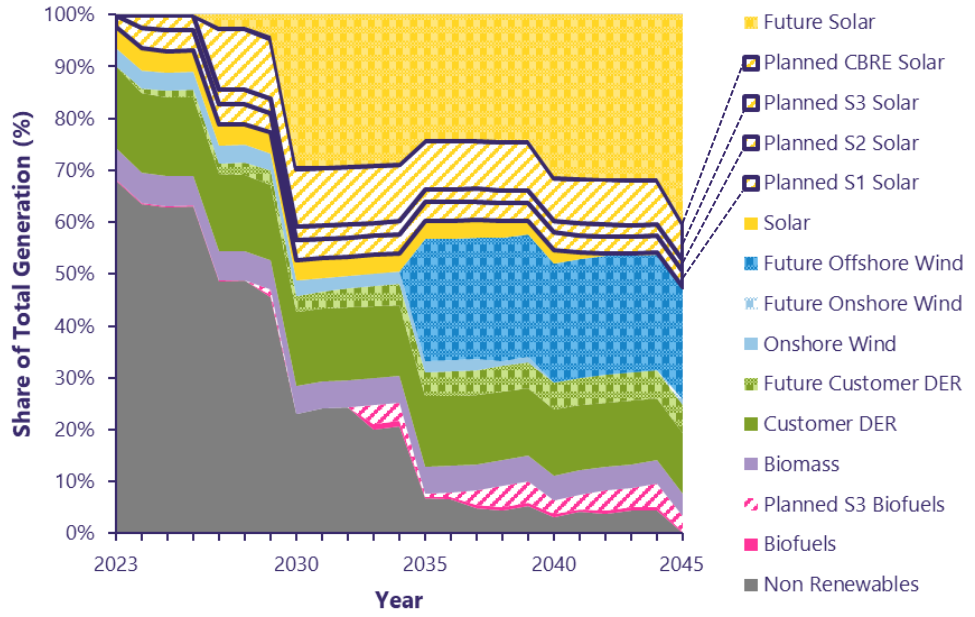

Figure 2-18. O'ahu: Alternate Plan resource generation mix (2023–2045)

Figure 2-19 shows the incremental change in capacity for the O'ahu Alternate Plan. For future solar and wind additions, the future capacity includes existing independent power producers that may be repowered after the expiration of their power purchase agreement.

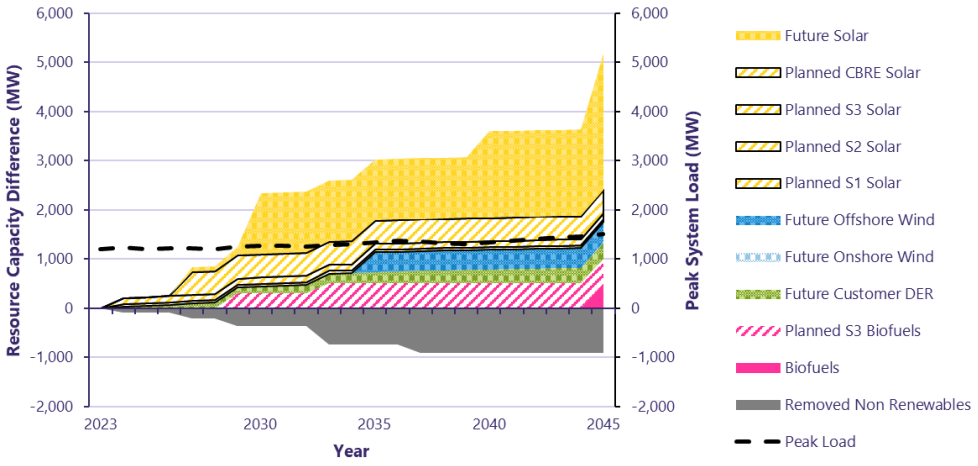

Figure 2-19. O'ahu: Alternate scenario change in installed capacity by resource type (2023–2045)

The charts below illustrate the capacity and energy of resources in the O'ahu Alternate Plan. Because future solar was made available in the Integrated Grid Plan modeling for this scenario in various renewable energy zones, several future solar resources are selected.

Figure 2-20 shows the installed capacity by resource in year 2030 for the O'ahu Alternate Plan.

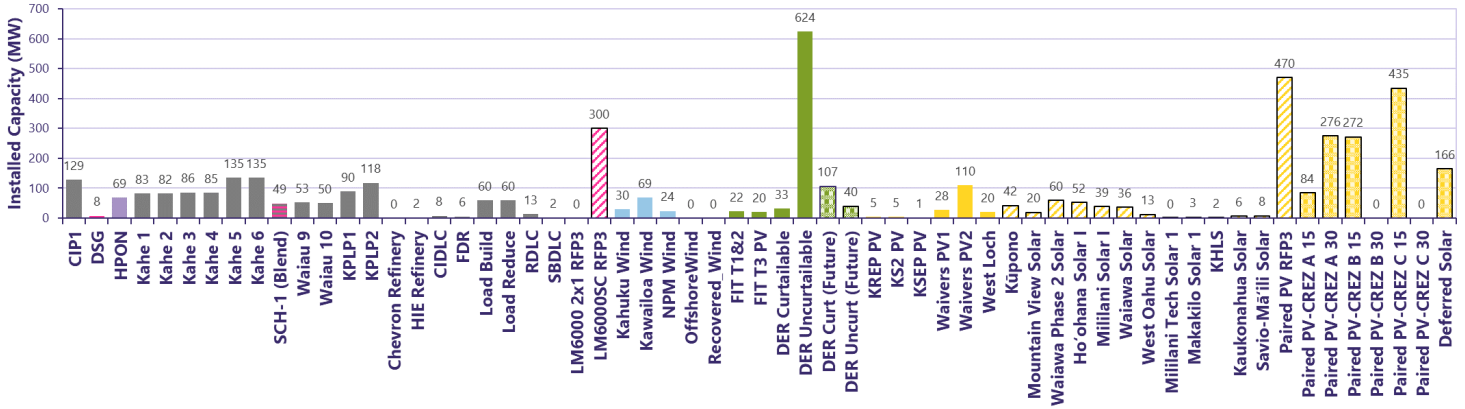

Figure 2-20. O'ahu: Alternate Plan installed capacity by resource (2030)

Figure 2-21 shows the installed capacity by resource in year 2035 for the O'ahu Alternate Plan.

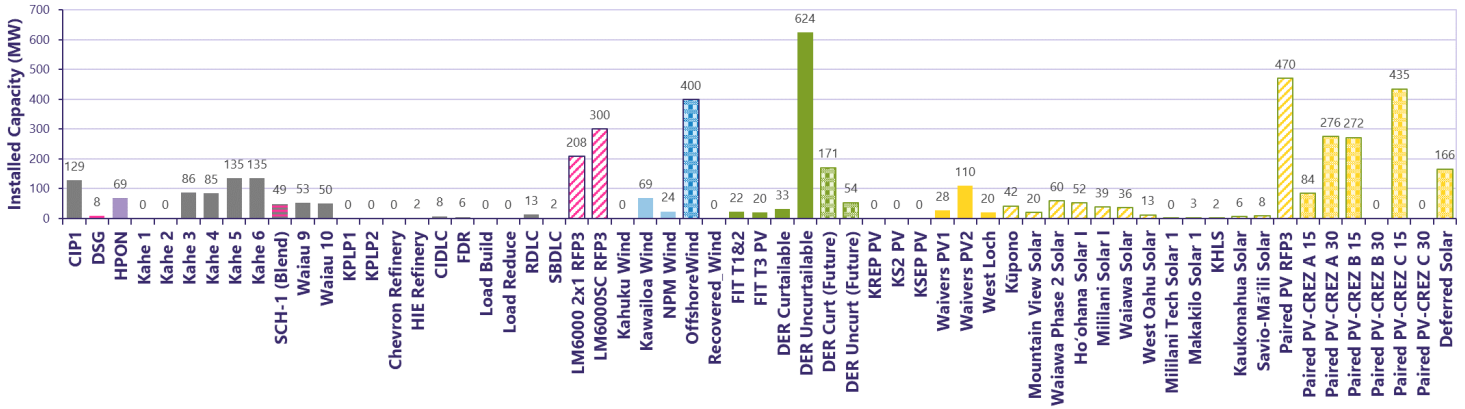

Figure 2-21. O'ahu: Alternate Plan installed capacity by resource (2035)

Figure 2-22 shows the installed capacity by resource in year 2040 for the O'ahu Alternate Plan.

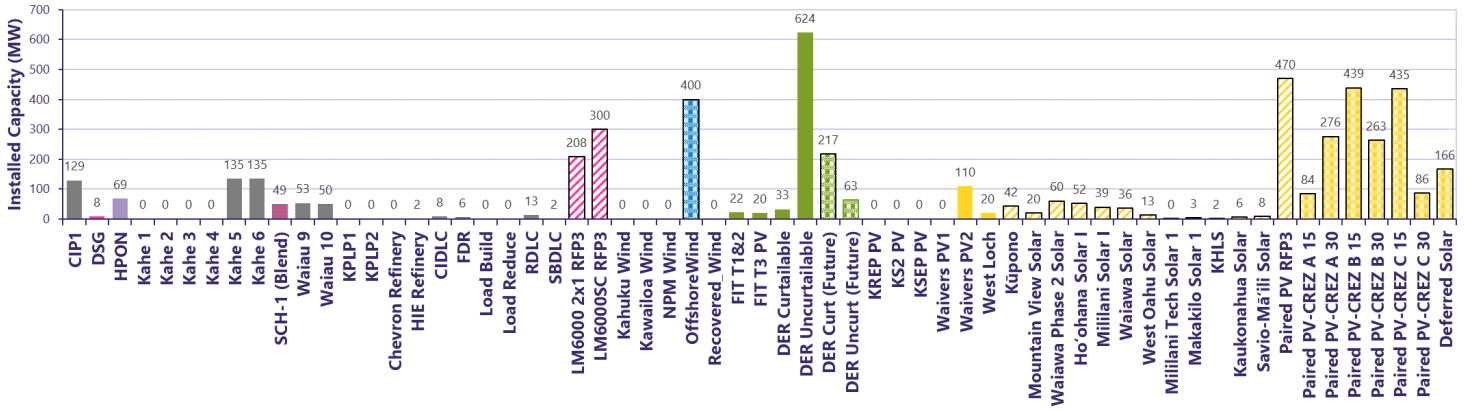

Figure 2-22. O'ahu: Alternate Plan installed capacity by resource (2040)

Figure 2-23 shows the installed capacity by resource in year 2045 for the O'ahu Alternate Plan.

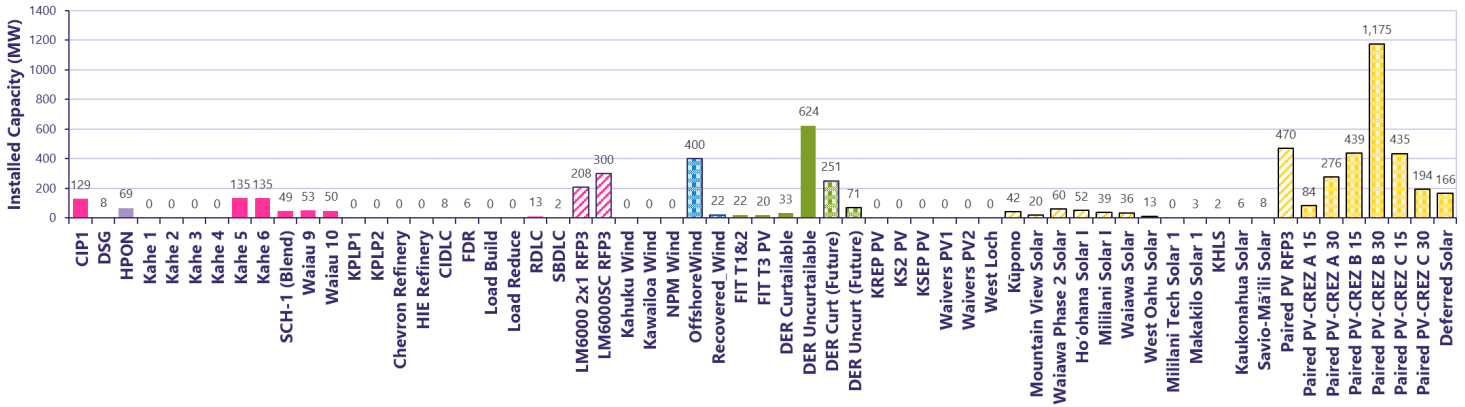

Figure 2-23. O'ahu: Alternate Plan installed capacity by resource (2045)

Figure 2-24 shows the generation by resource in year 2030 for the O'ahu Alternate Plan.

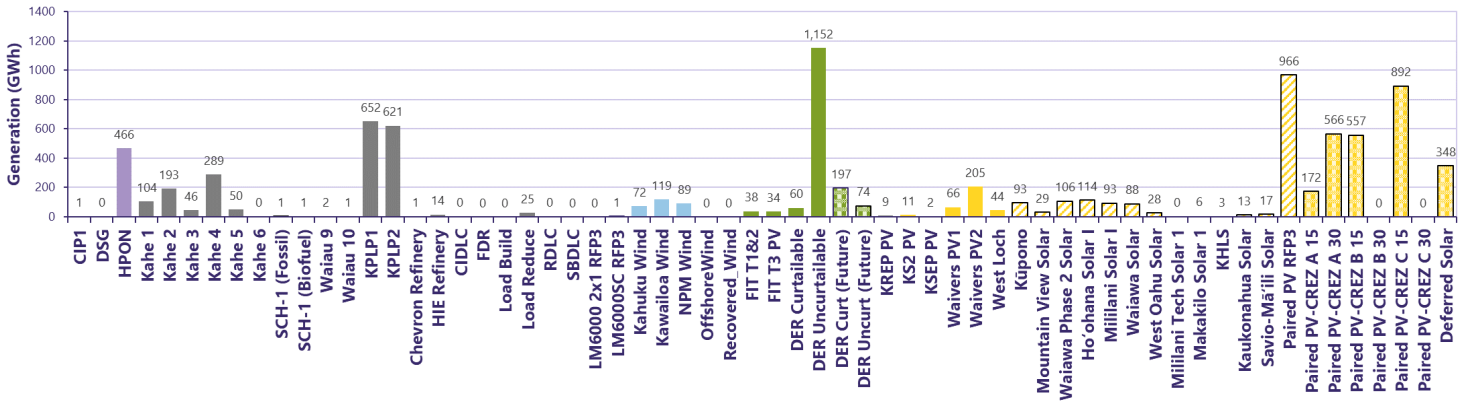

Figure 2-24. O'ahu: Alternate Plan generation by resource (2030)

Figure 2-25 shows the generation by resource in year 2035 for the O'ahu Alternate Plan.

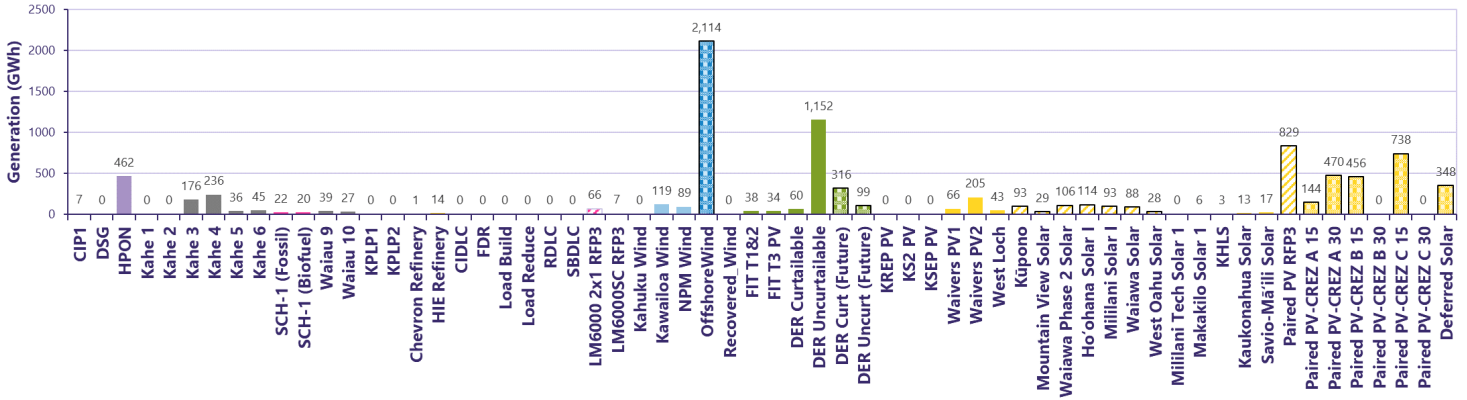

Figure 2-25. O'ahu: Alternate Plan generation by resource (2035)

Figure 2-26 shows the generation by resource in year 2040 for the O'ahu Alternate Plan.

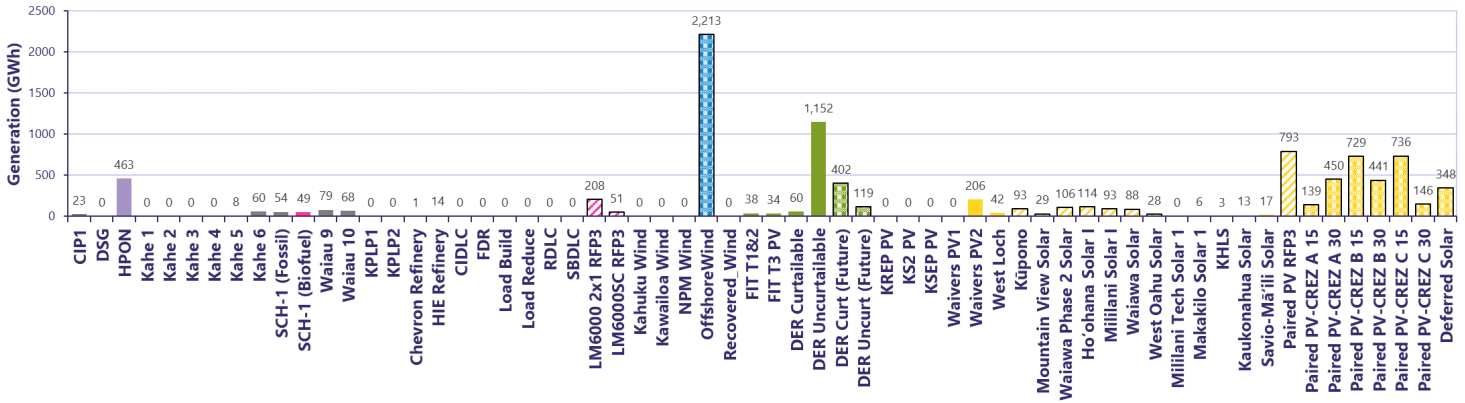

Figure 2-26. O'ahu: Alternate Plan generation by resource (2040)

Figure 2-27 shows the generation by resource in year 2045 for the O'ahu Alternate Plan.

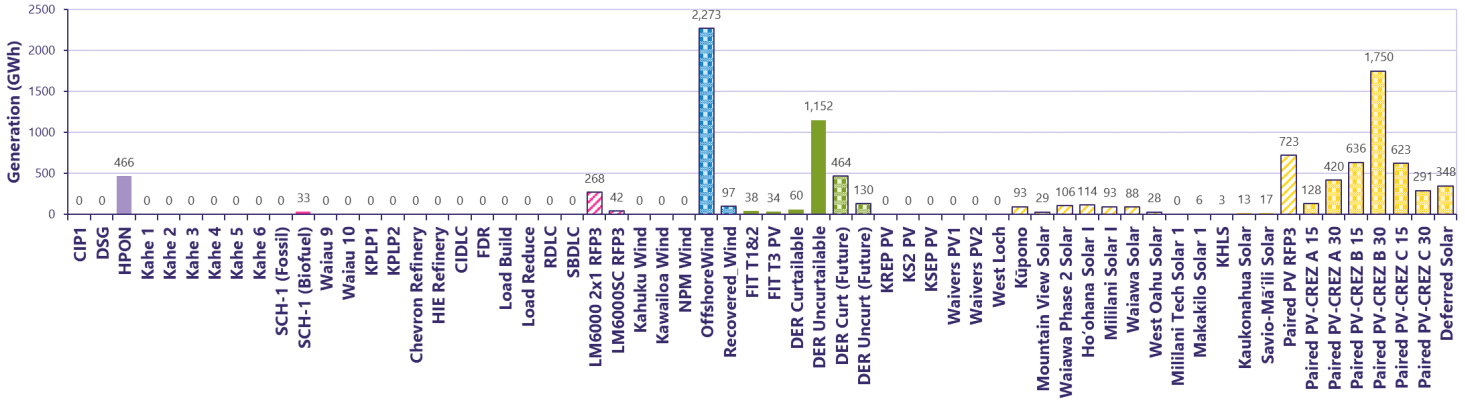

Figure 2-27. O'ahu: Alternate Plan generation by resource (2045)

Table 2-4 below summarizes the installed capacity and generation for each resource in the O'ahu Alternate Plan portfolio shown in the preceding figures. Each resource is accompanied by their full name or a brief description of the resource. Generators running on fossil fuel/biofuel blends have their generation proportionally split between non-renewable and renewable sources. In years where the installed capacity and generation are shown as zero, existing fossil fuel resources may be deactivated or their power purchase agreement expired.

Table 2-4. O'ahu: Alternate Plan installed capacity and generation by resource (2030, 2035, 2040, 2045)

Resource	Full Name / Description	Category	Installed Capacity (MW)				Generation (GWh)			
			2030	2035	2040	2045	2030	2035	2040	2045
CIP1	Campbell Industrial Park	Non-Renewables	129.0	129.0	129.0	129.0	1.1	7.3	23.5	0.0
DSG	Airport Emergency Power Facility	Biofuels	8.0	8.0	8.0	8.0	0.1	0.1	0.3	0.0
HPON	H-Power	Biomass	68.5	68.5	68.5	68.5	466.0	462.1	463.4	466.0
Kahe 1	Kahe 1	Non-Renewables	82.6	0.0	0.0	0.0	103.9	0.0	0.0	0.0
Kahe 2	Kahe 2	Non-Renewables	82.4	0.0	0.0	0.0	192.8	0.0	0.0	0.0
Kahe 3	Kahe 3	Non-Renewables	86.1	86.1	0.0	0.0	45.8	175.8	0.0	0.0
Kahe 4	Kahe 4	Non-Renewables	85.4	85.4	0.0	0.0	289.2	236.3	0.0	0.0
Kahe 5	Kahe 5	Non-Renewables	134.9	134.9	134.9	134.9	49.9	36.4	8.0	0.0
Kahe 6	Kahe 6	Non-Renewables	134.7	134.7	134.7	134.7	0.1	45.4	59.9	0.0
SCH-1 (Fossil)	Schofield (Fossil fuel portion of fuel blend)	Non-Renewables	48.8	48.8	48.8	48.8	1.2	22.1	53.7	0.0
SCH-1 (Biofuel)	Schofield (Biofuel portion of fuel blend)	Non-Renewables					1.1	20.3	49.2	33.0
Waiau 9	Waiau 9	Non-Renewables	52.9	52.9	52.9	52.9	1.7	38.5	79.2	0.0
Waiau 10	Waiau 10	Non-Renewables	49.9	49.9	49.9	49.9	0.7	27.1	68.5	0.0
KPLP1	Kalaeloa Partners 1	Non-Renewables	90.0	0.0	0.0	0.0	651.8	0.0	0.0	0.0
KPLP2	Kalaeloa Partners 2	Non-Renewables	118.0	0.0	0.0	0.0	620.8	0.0	0.0	0.0
Chevron Refinery	Chevron Refinery	Non-Renewables	0.1	0.1	0.1	0.0	0.9	0.9	0.9	0.0
HIE Refinery	HIE Refinery	Non-Renewables	1.7	1.7	1.7	0.0	14.4	14.4	14.5	0.0
CIDLC	Commercial Industrial Direct Load Control	Non-Renewables	7.8	7.8	7.8	7.8	0.1	0.1	0.1	0.1
FDR	Fast Demand Response	Non-Renewables	5.5	5.5	5.5	5.5	0.1	0.1	0.1	0.1
Load Build	Load Build	Non-Renewables	60.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Load Reduce	Load Reduce	Non-Renewables	60.0	0.0	0.0	0.0	24.6	0.0	0.0	0.0
RDLC	Residential Direct Load Control	Non-Renewables	13.2	13.2	13.2	13.2	0.3	0.3	0.3	0.3
SBDLC	Small Business Direct Load Control	Non-Renewables	1.6	1.6	1.6	1.6	0.0	0.0	0.0	0.0
LM6000 2x1 RFP3	Stage 3 RFP Proxy Firm Resource	Planned S3 Biofuels	0.0	208.0	208.0	208.0	0.0	65.6	207.6	267.6
LM6000SC RFP3	Stage 3 RFP Proxy Firm Resource	Planned S3 Biofuels	300.0	300.0	300.0	300.0	0.9	7.1	51.3	42.4
Kahuku Wind	Kahuku Wind	Onshore Wind	30.0	0.0	0.0	0.0	71.6	0.0	0.0	0.0
Kawailoa Wind	Kawailoa Wind	Onshore Wind	69.0	69.0	0.0	0.0	119.1	119.1	0.0	0.0
NPM Wind	Nā Pua Makani Wind	Onshore Wind	24.0	24.0	0.0	0.0	89.5	89.5	0.0	0.0
OffshoreWind	Future Offshore Wind Candidate Resource	Future Offshore Wind	0.0	400.0	400.0	400.0	0.0	2113.7	2213.2	2272.5

Resource	Full Name / Description	Category	Installed Capacity (MW)				Generation (GWh)			
			2030	2035	2040	2045	2030	2035	2040	2045
Recovered_Wind	Renewed Wind PPAs	Future Offshore Wind	0.0	0.0	0.0	22.0	0.0	0.0	0.0	97.1
FIT T1&2	FIT Tier 1 and 2	Customer DER	22.3	22.3	22.3	22.3	37.8	37.8	37.8	37.8
FIT T3 PV	FIT Tier 3	Customer DER	20.0	20.0	20.0	20.0	33.8	33.8	33.8	33.8
DER Curtailable	Curtailable DER (2023 Levels)	Customer DER	32.6	32.6	32.6	32.6	60.1	60.1	60.1	60.1
DER Uncurtailable	Uncurtailable DER (2023 Levels)	Customer DER	623.7	623.7	623.7	623.7	1151.6	1151.6	1151.6	1151.6
DER Curt (Future)	Curtailable DER (above 2023 Levels)	Future Customer DER	106.6	170.9	217.3	251.3	196.9	315.6	402.1	464.0
DER Uncurt (Future)	Uncurtailable DER (above 2023 Levels)	Future Customer DER	39.9	53.8	63.0	70.6	73.6	99.3	118.8	130.3
KREP PV	Kalaeloa Renewable Energy Park	Solar	5.0	0.0	0.0	0.0	9.0	0.0	0.0	0.0
KS2 PV	Kalaeloa Solar 2	Solar	5.0	0.0	0.0	0.0	11.3	0.0	0.0	0.0
KSEP PV	Kapolei Sustainable Energy Park	Solar	1.0	0.0	0.0	0.0	1.9	0.0	0.0	0.0
Waivers PV1	Waianae Solar	Solar	27.6	27.6	0.0	0.0	65.6	65.6	0.0	0.0
Waivers PV2	Kawailoa Solar, Lanikuhana Solar, Waipio Solar	Solar	109.6	109.6	109.6	0.0	205.1	205.1	205.5	0.0
West Loch	West Loch Solar	Solar	20.0	20.0	20.0	0.0	44.3	43.1	41.9	0.0
Kūpono	Kūpono Solar	Planned S2 Solar	42.0	42.0	42.0	42.0	93.3	93.3	93.3	93.3
Mountain View Solar	Mountain View Solar	Planned S2 Solar	19.5	19.5	19.5	19.5	28.9	29.0	29.0	29.0
Waiawa Phase 2 Solar	Waiawa Phase 2 Solar	Planned S2 Solar	60.0	60.0	60.0	60.0	105.8	105.9	105.9	105.9
Hoʻohana Solar I	Hoʻohana Solar I	Planned S1 Solar	52.0	52.0	52.0	52.0	114.5	114.5	114.5	114.5
Mililani Solar I	Mililani Solar I	Planned S1 Solar	39.0	39.0	39.0	39.0	93.1	93.1	93.1	93.1
Waiawa Solar	Waiawa Solar	Planned S1 Solar	36.0	36.0	36.0	36.0	87.9	87.9	87.9	87.9
West Oahu Solar	West Oahu Solar	Planned S1 Solar	12.5	12.5	12.5	12.5	27.6	27.6	27.6	27.6
Mililani Tech Solar 1	Mililani Tech Solar 1	Planned CBRE Solar	0.3	0.3	0.3	0.3	0.5	0.5	0.5	0.5
Makakilo Solar 1	Makakilo Solar 1	Planned CBRE Solar	3.0	3.0	3.0	3.0	5.5	5.5	5.6	5.5
KHLS	Kalaeloa Home Lands Solar LLC	Planned CBRE Solar	1.7	1.7	1.7	1.7	3.2	3.2	3.2	3.2
Kaukonahua Solar	Kaukonahua Solar	Planned CBRE Solar	6.0	6.0	6.0	6.0	12.9	12.9	12.9	12.9
Savio-Māʻili Solar	Savio-Māʻili Solar	Planned CBRE Solar	8.1	8.1	8.1	8.1	17.3	17.3	17.3	17.3
Paired PV RFP3	Stage 3 RFP Proxy Solar Resource	Planned S3 Solar	470.0	470.0	470.0	470.0	966.1	829.5	793.2	723.1
Paired PV-CREZ A 15	Future Solar Candidate Resource Zone A, 15 degree slope	Future Solar	84.0	84.0	84.0	84.0	172.0	144.3	139.5	127.7
Paired PV-CREZ A 30	Future Solar Candidate Resource Zone A, 30 degree slope	Future Solar	276.0	276.0	276.0	276.0	565.7	469.6	450.1	420.3
Paired PV-CREZ B 15	Future Solar Candidate Resource Zone B, 15 degree slope	Future Solar	272.0	272.0	439.0	439.0	556.7	456.2	728.9	635.7
Paired PV-CREZ B 30	Future Solar Candidate Resource Zone B, 30 degree slope	Future Solar	0.0	0.0	263.0	1175.0	0.0	0.0	441.1	1749.6
Paired PV-CREZ C 15	Future Solar Candidate Resource Zone C, 15 degree slope	Future Solar	435.0	435.0	435.0	435.0	891.8	737.6	736.4	623.5
Paired PV-CREZ C 30	Future Solar Candidate Resource Zone C, 30 degree slope	Future Solar	0.0	0.0	86.0	194.0	0.0	0.0	146.5	291.1
Deferred Solar	Difference in pre-Stage 3 procurement targets and actual procurements	Future Solar	165.9	165.9	165.9	165.9	347.9	347.9	348.0	347.9

As described earlier in Section 2.1.1, there are fewer scenarios in the O'ahu Alternate Plan where the installed resources in the portfolio may not be enough to meet resource adequacy, given the large amounts of hybrid solar that are assumed. However, because we need to select a plan that all stakeholders can commit to achieve that considers implementation, land use and community acceptance concerns, the resources in the O'ahu Preferred Plan are more appropriate to assume in the near term.

Figure 2-28 and Figure 2-29 illustrate the capacity and energy by technology that is included in the Alternate Plan.

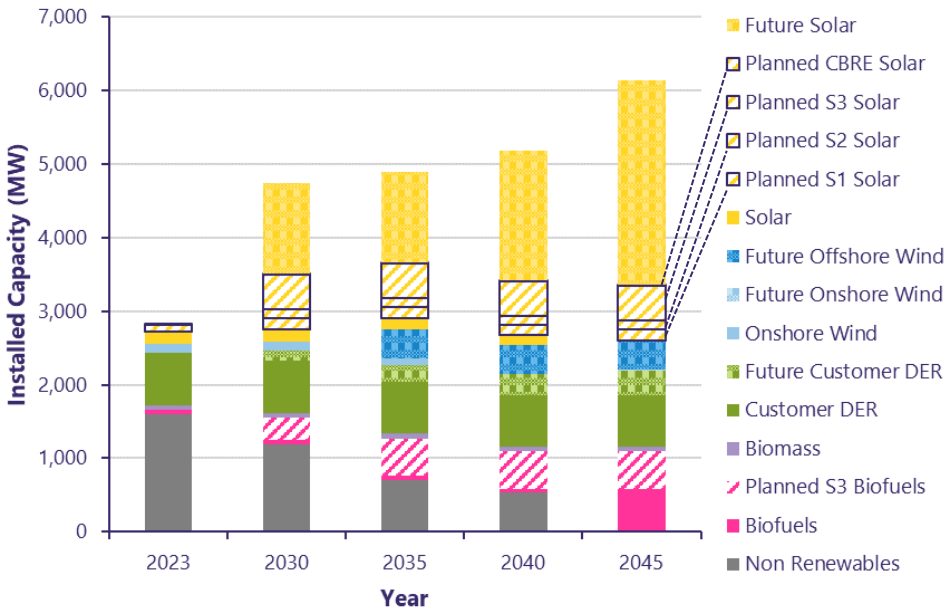

Figure 2-28. O'ahu: Alternate Plan installed capacity by resource type (2023–2045)

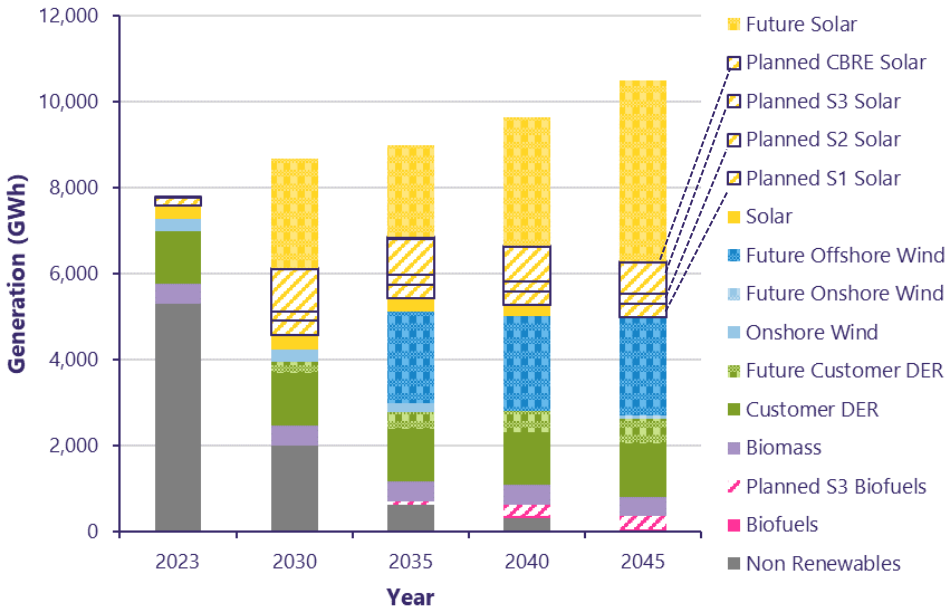

Figure 2-29. O'ahu: Alternate Plan generation by resource type (2023–2045)

In addition to generation needs, the system security study in Appendix D of the Integrated Grid Plan evaluated O'ahu steady-state and dynamic stability transmission system needs under base and high load scenarios. O'ahu transmission system upgrade and renewable energy zone enablement costs are summarized in Table 2-4. When modeling the high load resource plan, the system security study identified additional network expansion and renewable energy zone enablement mitigations and costs compared to the alternate plan.

Table 2-5. O'ahu transmission needs cost estimate in million dollars by studied years (2030, 2035, 2045, 2050)

Category	Alternate Plan (Base)				High Load Resource Plan	
	2030	2035	2045	2050	2030	2035
Transmission Network Expansion	161.4	0	3,821.2	1,208.9	1,219.3	397.9
REZ Enablement	560.6 – 932.1	50.6	1,649.6-2,033.5	979.4-1,052.6	1,491.0-1,830.2	50.6

2.2 Hawai'i Island

The pie and stacked area charts below provide the capacity and energy for the Hawai'i Island Preferred Plan using the results of the Hawai'i Island base scenario.

Figure 2-30 shows the generation by resource type in key years over the planning horizon for the Hawai'i Island Preferred Plan.

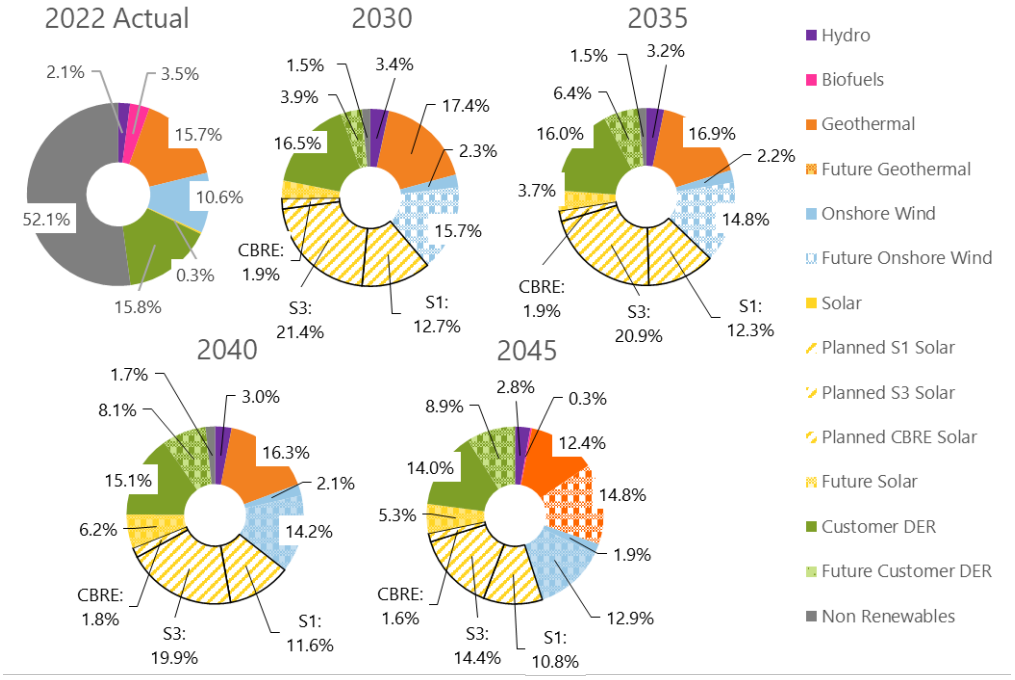

Figure 2-30. Preferred Plan generation mix: Hawai'i Island

Figure 2-31 shows the change in capacity over time for the Hawai'i Island Preferred Plan.

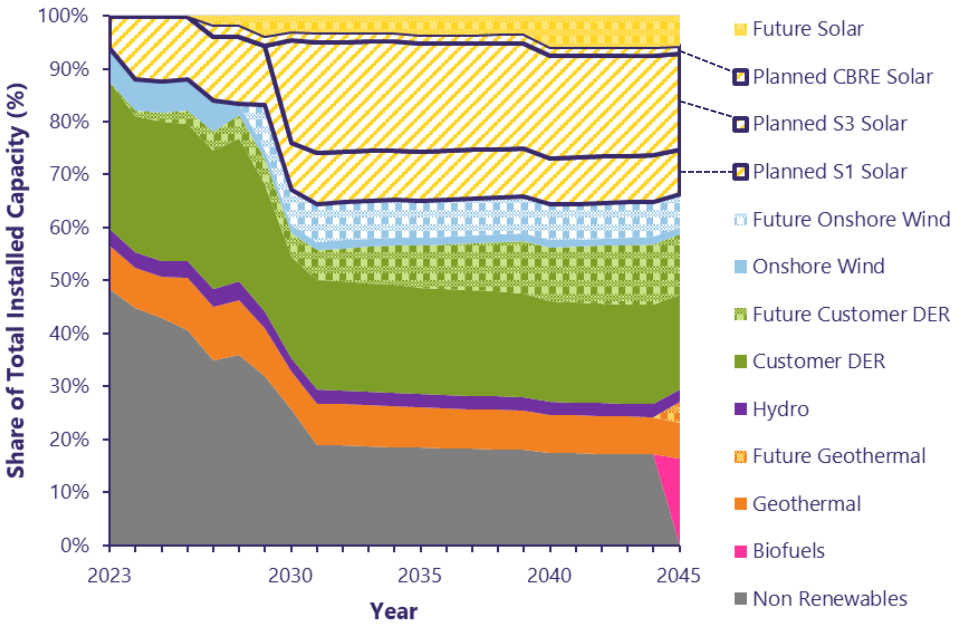

Figure 2-31. Hawai'i Island: Preferred Plan resource installed capacity mix (2023–2045)

Figure 2-32 shows the change in generation over time for the Hawai'i Island Preferred Plan.

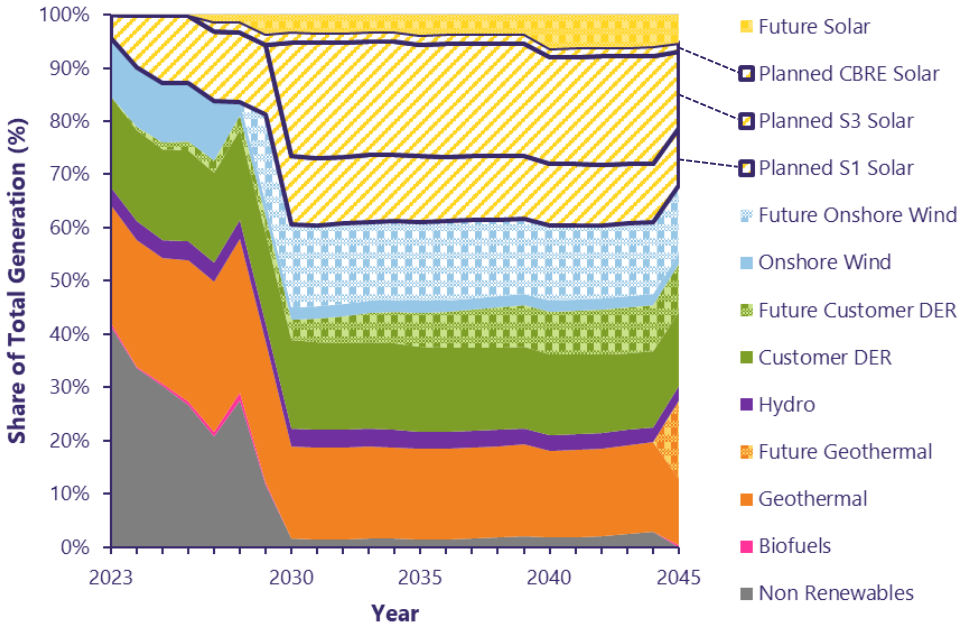

Figure 2-32. Hawai'i Island: Preferred Plan resource generation mix (2023–2045)

Figure 2-33 shows the incremental change in capacity for the Hawai'i Island Preferred Plan. For future solar and wind additions, the future capacity includes existing independent power producers that may be repowered after the expiration of their power purchase agreement.

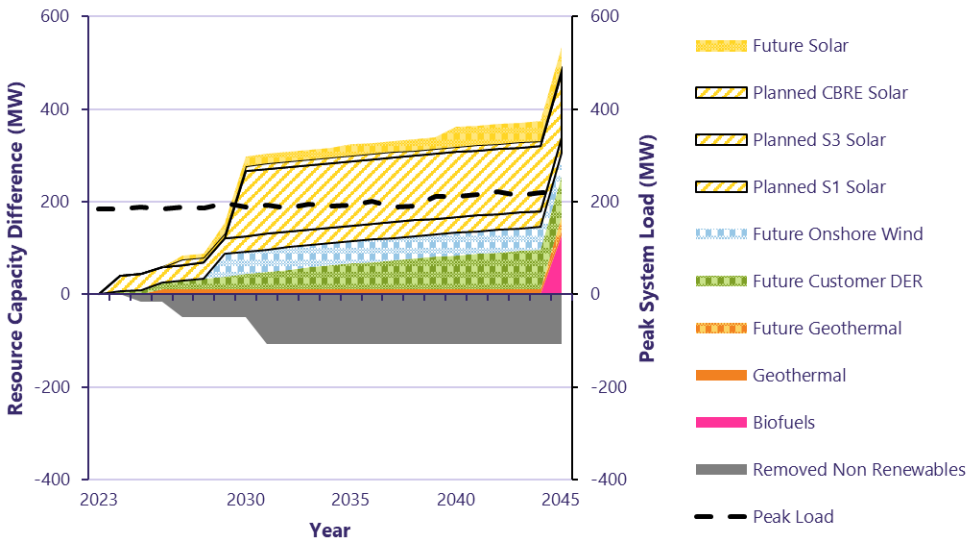

Figure 2-33. Hawai'i Island: Preferred Plan change in installed capacity by resource type (2023–2045)

Figure 2-34 shows the installed capacity by resource in year 2030 for the Hawai'i Island Preferred Plan.

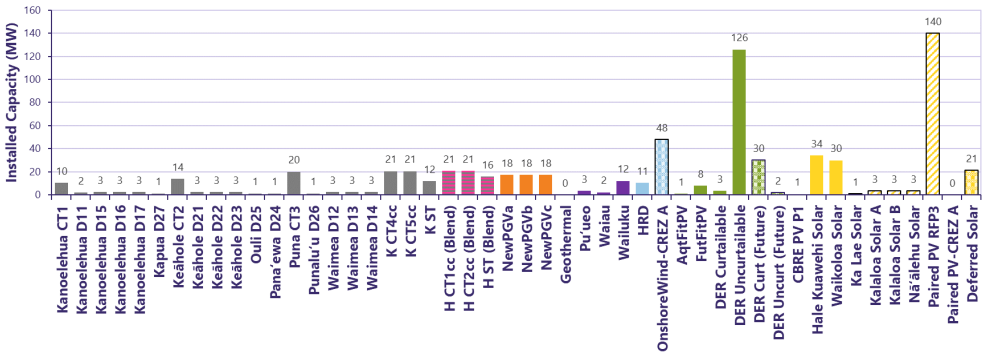

Figure 2-34. Hawai'i Island: Preferred Plan installed capacity by resource (2030)

Figure 2-35 shows the installed capacity by resource in year 2035 for the Hawai'i Island Preferred Plan.

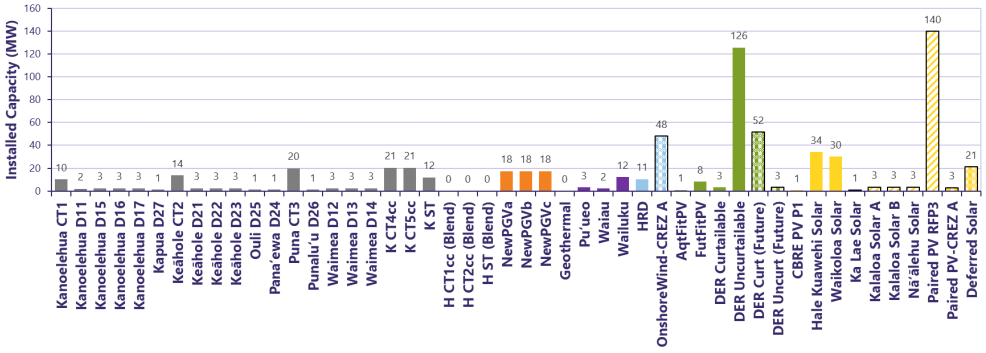

Figure 2-35. Hawai'i Island: Preferred Plan installed capacity by resource (2035)

Figure 2-36 shows the installed capacity by resource in year 2040 for the Hawai'i Island Preferred Plan.

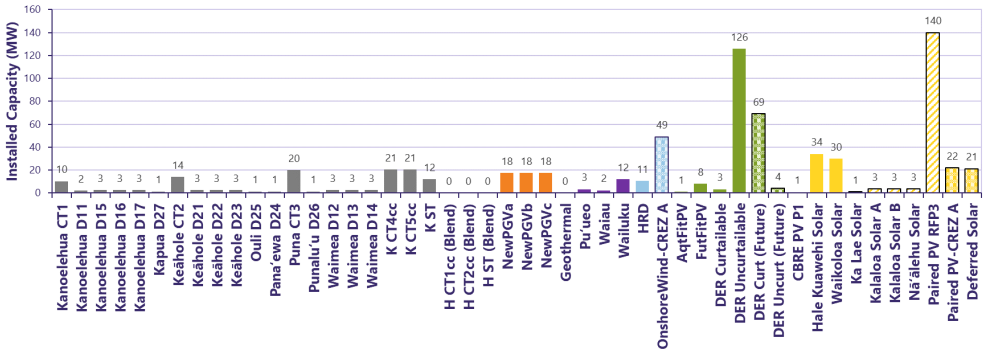

Figure 2-36. Hawai'i Island: Preferred Plan installed capacity by resource (2040)

Figure 2-37 shows the installed capacity by resource in year 2045 for the Hawai'i Island Preferred Plan.

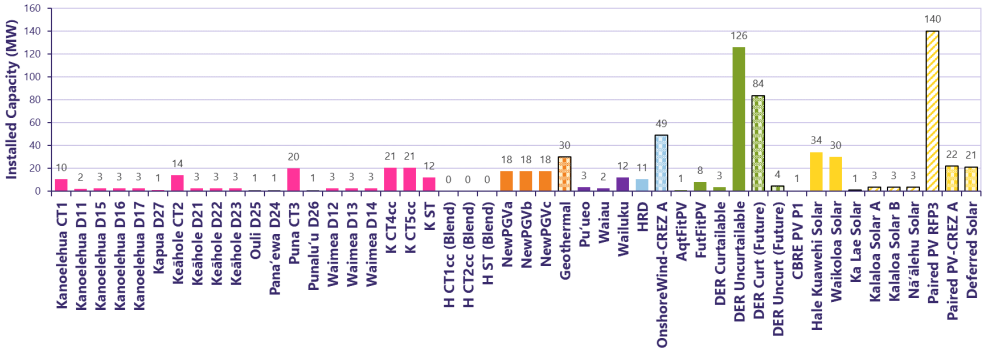

Figure 2-37. Hawai'i Island: Preferred Plan installed capacity by resource (2045)

Figure 2-38 shows the generation by resource in year 2030 for the Hawai'i Island Preferred Plan.

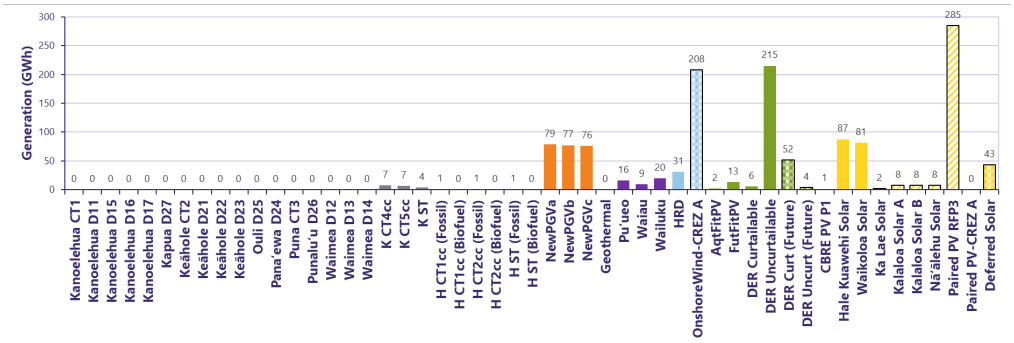

Figure 2-38. Hawai'i Island: Preferred Plan generation by resource (2030)

Figure 2-39 shows the generation by resource in year 2035 for the Hawai'i Island Preferred Plan.

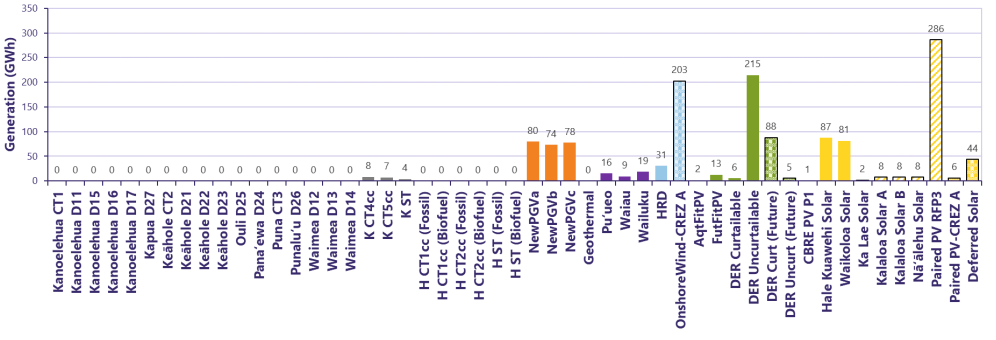

Figure 2-39. Hawai'i Island: Preferred Plan generation by resource (2035)

Figure 2-40 shows the generation by resource in year 2040 for the Hawai'i Island Preferred Plan.

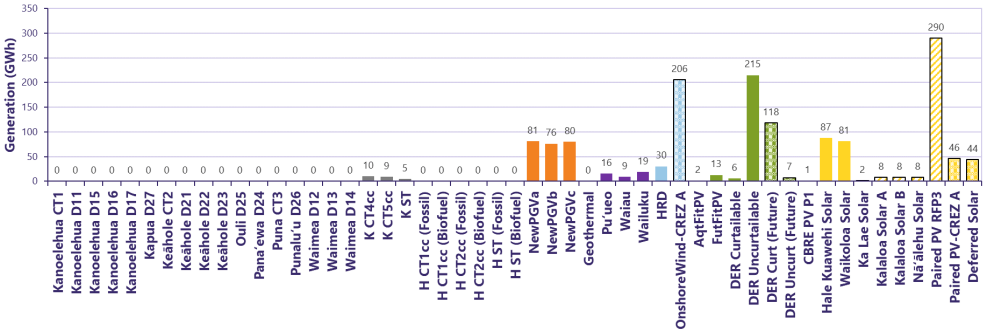

Figure 2-40. Hawai'i Island: Preferred Plan generation by resource (2040)

Figure 2-41 shows the generation by resource in year 2045 for the Hawai'i Island Preferred Plan.

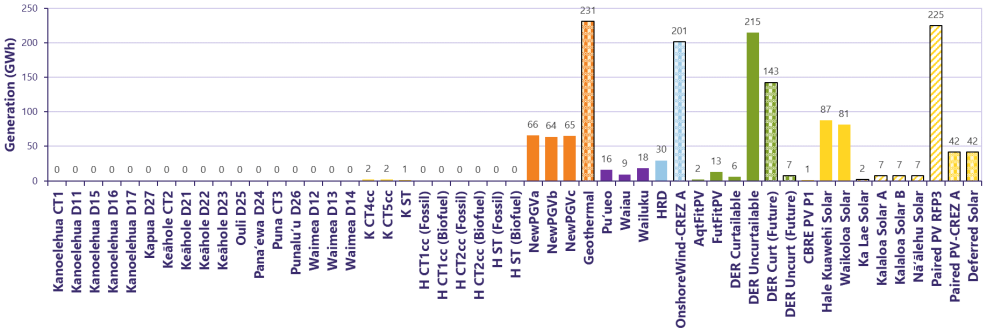

Figure 2-41. Hawai'i Island: Preferred Plan generation by resource (2045)

Table 2-6 below summarizes the installed capacity and generation for each resource in the Hawai'i Island Preferred Plan portfolio shown in the preceding figures. Each resource is accompanied by their full name or a brief description of the resource. Generators running on fossil fuel/biofuel blends have their generation proportionally split between non-renewable and renewable sources. In years where the installed capacity and generation are shown as zero, existing fossil fuel resources may be deactivated or their power purchase agreement expired.

Table 2-6. Hawai'i Island: Preferred scenario installed capacity and generation by resource (2030, 2035, 2040, 2045)

Resource	Full Name / Description	Category	Installed Capacity (MW)				Generation (GWh)			
			2030	2035	2040	2045	2030	2035	2040	2045
Kanoelehua CT1	Kanoelehua CT1	Non-Renewables	10.3	10.3	10.3	10.3	0.0	0.0	0.0	0.0
Kanoelehua D11	Kanoelehua D11	Non-Renewables	2.0	2.0	2.0	2.0	0.0	0.0	0.0	0.0
Kanoelehua D15	Kanoelehua D15	Non-Renewables	2.5	2.5	2.5	2.5	0.0	0.0	0.0	0.0
Kanoelehua D16	Kanoelehua D16	Non-Renewables	2.5	2.5	2.5	2.5	0.0	0.0	0.0	0.0
Kanoelehua D17	Kanoelehua D17	Non-Renewables	2.5	2.5	2.5	2.5	0.0	0.0	0.0	0.0
Kapua D27	Kapua D27	Non-Renewables	1.3	1.3	1.3	1.3	0.0	0.0	0.1	0.0
Keāhole CT2	Keāhole CT2	Non-Renewables	13.8	13.8	13.8	13.8	0.0	0.0	0.0	0.0
Keāhole D21	Keāhole D21	Non-Renewables	2.5	2.5	2.5	2.5	0.0	0.0	0.0	0.0
Keāhole D22	Keāhole D22	Non-Renewables	2.5	2.5	2.5	2.5	0.0	0.0	0.0	0.0
Keāhole D23	Keāhole D23	Non-Renewables	2.5	2.5	2.5	2.5	0.0	0.0	0.0	0.0
Ouli D25	Ouli D25	Non-Renewables	1.3	1.3	1.3	1.3	0.0	0.0	0.0	0.0
Pana'ewa D24	Pana'ewa D24	Non-Renewables	1.3	1.3	1.3	1.3	0.2	0.2	0.4	0.1
Puna CT3	Puna CT3	Non-Renewables	20.0	20.0	20.0	20.0	0.2	0.4	0.4	0.1
Punalu'u D26	Punalu'u D26	Non-Renewables	1.3	1.3	1.3	1.3	0.0	0.0	0.1	0.0
Waimea D12	Waimea D12	Non-Renewables	2.5	2.5	2.5	2.5	0.0	0.0	0.0	0.0
Waimea D13	Waimea D13	Non-Renewables	2.5	2.5	2.5	2.5	0.0	0.0	0.0	0.0
Waimea D14	Waimea D14	Non-Renewables	2.5	2.5	2.5	2.5	0.0	0.0	0.0	0.0
K CT4cc	Keāhole CT4	Non-Renewables	20.5	20.5	20.5	20.5	7.3	8.4	10.1	1.7
K CT5cc	Keāhole CT5	Non-Renewables	20.5	20.5	20.5	20.5	6.5	7.3	9.2	2.0
K ST	Keāhole ST7	Non-Renewables	12.0	12.0	12.0	12.0	3.6	3.8	4.8	0.9
H CT1cc (Fossil)	Hamakua Energy CT1 (Fossil fuel portion of fuel blend)	Non-Renewables	20.8	0.0	0.0	0.0	0.7	0.0	0.0	0.0
H CT1cc (Biofuel)	Hamakua Energy CT1 (Biofuel portion of fuel blend)	Biofuels	20.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
H CT2cc (Fossil)	Hamakua Energy CT2 (Fossil fuel portion of fuel blend)	Non-Renewables	20.8	0.0	0.0	0.0	0.8	0.0	0.0	0.0
H CT2cc (Biofuel)	Hamakua Energy CT2 (Biofuel portion of fuel blend)	Biofuels	20.8	0.0	0.0	0.0	0.2	0.0	0.0	0.0
H ST (Fossil)	Hamakua Energy ST (Fossil fuel portion of fuel blend)	Non-Renewables	16.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0
H ST (Biofuel)	Hamakua Energy ST (Biofuel portion of fuel blend)	Biofuels	16.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
NewPGVa	Puna Geothermal Venture Part 1	Geothermal	17.5	17.5	17.5	17.5	78.7	80.2	81.3	65.9
NewPGVb	Puna Geothermal Venture Part 2	Geothermal	17.5	17.5	17.5	17.5	77.2	73.7	76.1	63.8
NewPGVc	Puna Geothermal Venture Part 3	Geothermal	17.5	17.5	17.5	17.5	75.6	77.7	79.9	64.8
Geothermal	Future Geothermal Candidate Resource	Future Geothermal	0.0	0.0	0.0	30.0	0.0	0.0	0.0	231.2
Pu'ueo	Pu'ueo	Hydro	3.4	3.4	3.4	3.4	15.7	15.7	15.7	15.7

Resource	Full Name / Description	Category	Installed Capacity (MW)				Generation (GWh)			
			2030	2035	2040	2045	2030	2035	2040	2045
Waiau	Waiau	Hydro	2.3	2.3	2.3	2.3	9.4	9.4	9.4	9.4
Wailuku	Wailuku	Hydro	12.1	12.1	12.1	12.1	19.7	19.1	18.7	18.5
HRD	Hawi Renewable Development	Onshore Wind	10.5	10.5	10.5	10.5	31.0	30.6	30.4	29.5
OnshoreWind-CREZ A	Future Onshore Wind Candidate Resource	Future Onshore Wind	48.0	48.0	49.0	49.0	208.1	202.8	205.7	201.4
AqtFitPV	Acquired Uncurtailable FIT	Customer DER	1.0	1.0	1.0	1.0	1.6	1.6	1.6	1.6
FutFitPV	Future Curtailable FIT	Customer DER	8.1	8.1	8.1	8.1	12.9	12.9	12.9	12.9
DER Curtailable	Curtailable DER (2023 Levels)	Customer DER	3.3	3.3	3.3	3.3	5.7	5.7	5.7	5.7
DER Uncurtailable	Uncurtailable DER (2023 Levels)	Customer DER	125.9	125.9	125.9	125.9	214.8	214.8	214.8	214.8
DER Curt (Future)	Curtailable DER (above 2023 Levels)	Future Customer DER	30.4	51.6	69.2	83.6	51.8	88.0	118.4	142.7
DER Uncurt (Future)	Uncurtailable DER (above 2023 Levels)	Future Customer DER	2.2	3.2	3.9	4.3	3.7	5.4	7.2	7.4
CBRE PV P1	South Point Solar	Planned CBRE Solar	0.8	0.8	0.8	0.8	1.3	1.3	1.3	1.3
Hale Kuawehi Solar	Hale Kuawehi Solar	Planned S1 Solar	34.1	34.1	34.1	34.1	87.4	87.4	87.4	87.4
Waikoloa Solar	Waikoloa Solar	Planned S1 Solar	30.0	30.0	30.0	30.0	81.4	81.4	81.4	81.4
Ka Lae Solar	Ka Lae Solar	Planned CBRE Solar	1.0	1.0	1.0	1.0	1.7	1.7	1.7	1.7
Kalaloa Solar A	Kalaloa Solar A	Planned CBRE Solar	3.4	3.4	3.4	3.4	7.5	7.8	7.7	7.2
Kalaloa Solar B	Kalaloa Solar B	Planned CBRE Solar	3.4	3.4	3.4	3.4	7.5	7.8	7.7	7.2
Nāʻālehu Solar	Nāʻālehu Solar	Planned CBRE Solar	3.4	3.4	3.4	3.4	7.5	7.8	7.7	7.2
Paired PV RFP3	Stage 3 RFP Proxy Solar Resource	Planned S3 Solar	140.0	140.0	140.0	140.0	284.5	286.3	289.9	225.1
Paired PV-CREZ A	Future Solar Candidate Resource	Future Solar PV	0.0	3.0	22.0	22.0	0.0	6.1	46.4	41.8
Deferred Solar	Difference in pre-Stage 3 procurement targets and actual procurements	Future Solar PV	21.2	21.2	21.2	21.2	43.1	44.1	43.8	41.6

Due to modeled projects that have withdrawn or program targets that have not been fulfilled, approximately 21 MW of additional solar resources are needed to meet Hawai'i Island's Preferred Plan for 2030. This deferred solar capacity is due to CBRE program target shortfalls.

The Stage 3 RFP process is still ongoing and will have a significant impact on whether near-term reliability can be met, depending on the quantity, size, resource type and timing of proposals selected in the final award group, and if those proposals reach commercial operations. By 2030, 140 MW of new hybrid solar resources were assumed to be procured through the Stage 3 RFP.

Figure 2-42 and Figure 2-43 illustrate the capacity and energy by technology that is included in the Hawai'i Island Preferred Plan.

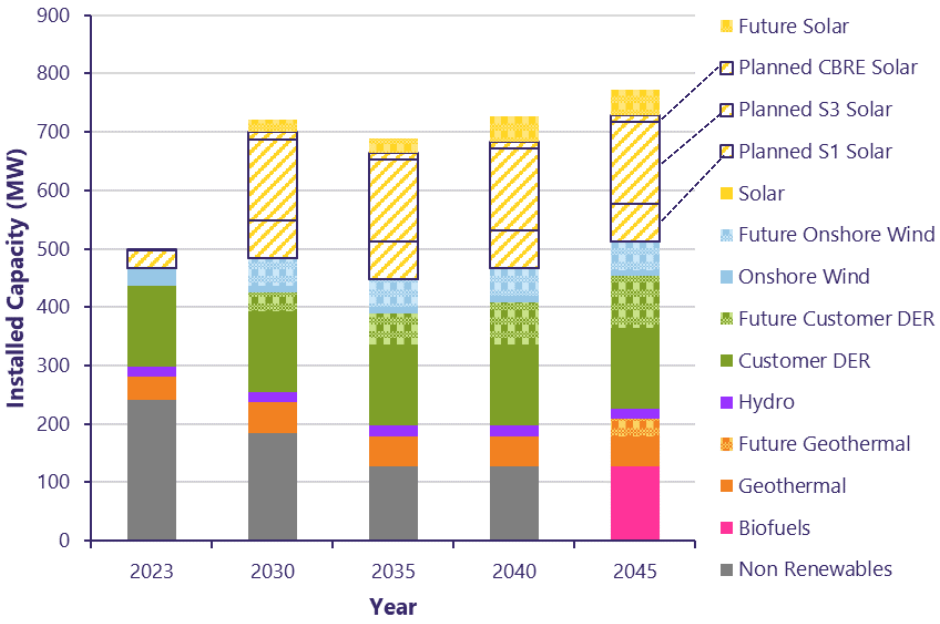

Figure 2-42. Hawai'i Island: Preferred Plan installed capacity by resource type (2023–2045)

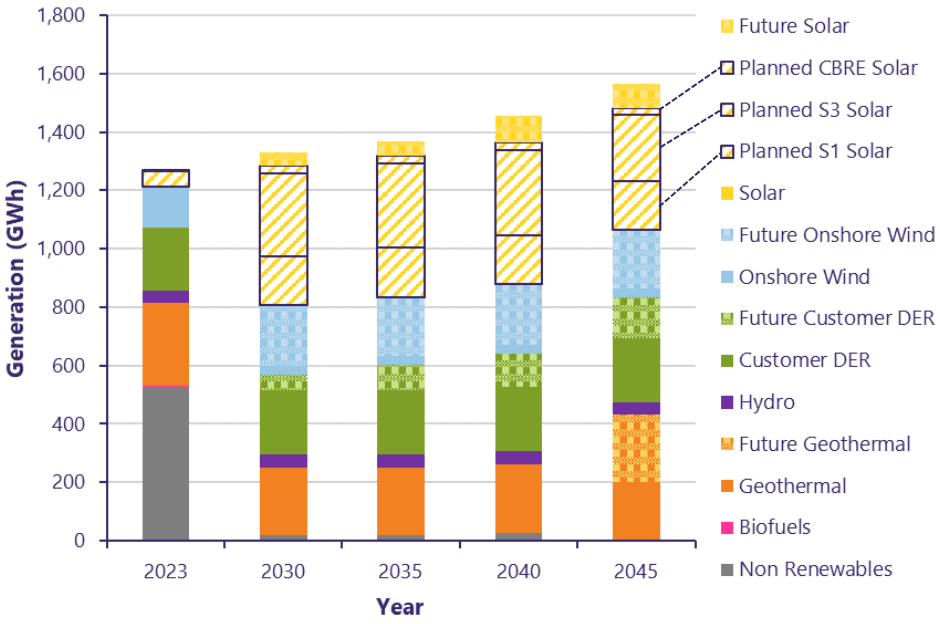

Figure 2-43. Hawai'i Island: Preferred Plan generation by resource type (2023–2045)

Hawai'i Island resource adequacy needs were evaluated under other scenarios in Sections 8.3.2, 12.3.2 and Appendix C to address:

- Higher than expected loads
- Deactivation of more or less existing firm generation depending on the amount of new resources that can be installed in the near term
- Incremental additions of hybrid solar resources
- Incremental additions of firm resources

In Table 12-7 in Section 12.3.2, under the 2030 base load, we show that a 0.1 loss of load expectation can be met without the addition of new resources. However, in Table 12-8, we show that the Hawai'i Island system is very sensitive to a high load where even the addition of new hybrid solar through the Stage 3 RFP is not enough to meet 0.1 loss of load expectation. Under a high load, more than 560 MW of hybrid solar (Stage 3 + future solar) or 50 MW of firm resources are needed to meet a 0.1 loss of load expectation.

In addition to generation needs, the system security study in Appendix D of the Integrated Grid Plan evaluated Hawai'i Island steady-state (i.e., transmission network expansion and renewable energy zone enablement) and dynamic stability transmission system needs under base and high load resource plans. Hawai'i Island transmission system upgrade and renewable energy zone enablement costs are summarized in Table 2-7. When modeling the high load resource plan, additional network expansion and renewable energy zone enablement mitigations and costs were identified compared to the Preferred Plan (base load scenario).

Table 2-7. Hawai'i Island transmission needs cost estimate in million dollars by studied years (2032, 2036 and 2050)

Category	Preferred Plan (Base)		High Load Resource Plan	
	2032	2050	2032	2036
Transmission Networks Expansion	0	100.1	10.9	121.5
REZ Enablement	37.8	52.4	37.8	24.5

2.3 Maui

The pie and stacked area charts below provide the capacity and energy for the Maui Preferred Plan using the results of the Maui base scenario. As we plan for the long-term rebuilding of transmission and distribution in Maui, we may need to make changes to the identified renewable energy zones based on feedback provided by community leaders, stakeholders and government officials. Certain renewable energy zones may be reduced in size or removed entirely as the long-term rebuild unfolds, resulting in less renewable energy than was selected in the Maui Preferred Plan.

Figure 2-44 shows the generation by resource type in key years over the planning horizon for the Maui Preferred Plan.

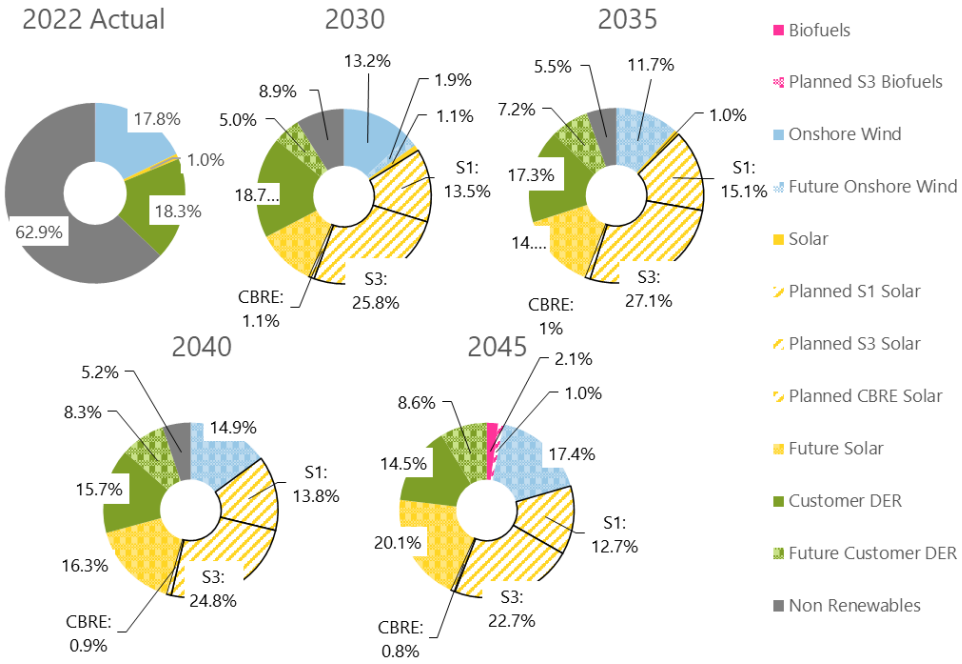

Figure 2-44. Preferred Plan generation mix: Maui

Figure 2-45 shows the change in capacity over time for the Maui Preferred Plan.

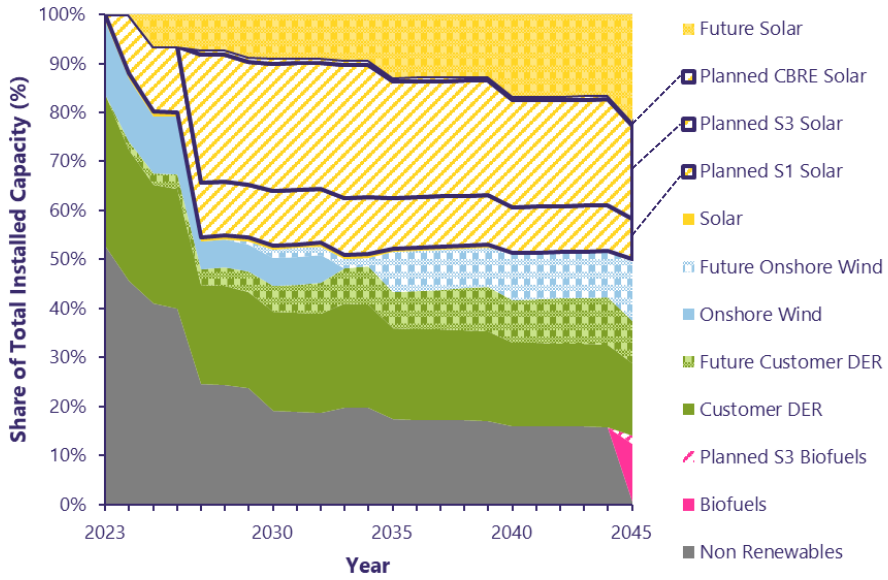

Figure 2-45. Maui: Preferred Plan resource installed capacity mix (2023–2045)

Figure 2-46 shows the change in generation over time for the Maui Preferred Plan.

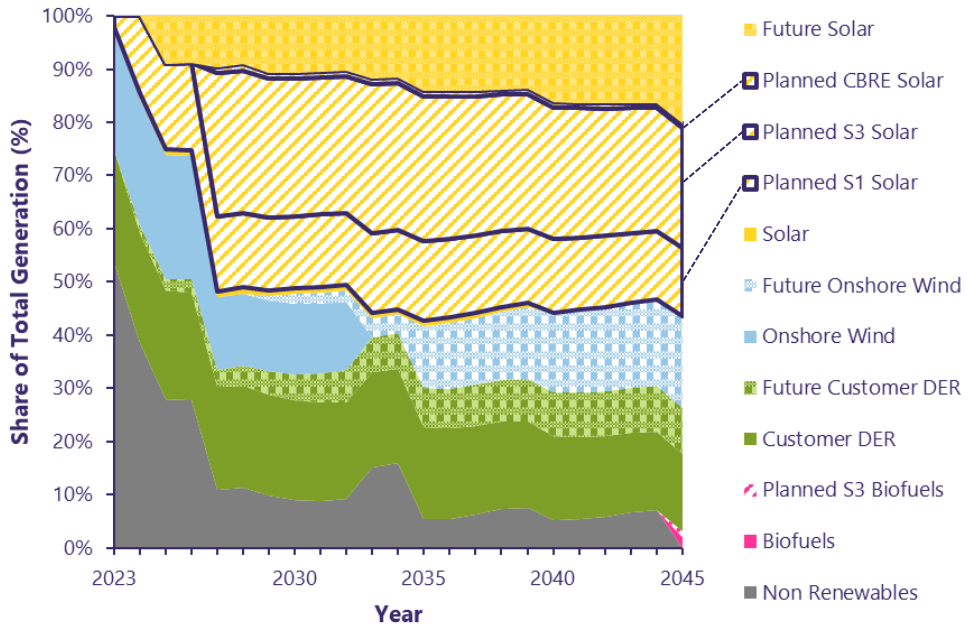

Figure 2-46. Maui: Preferred Plan resource generation mix (2023–2045)

Figure 2-47 shows the incremental change in capacity for the Maui Preferred Plan. For future solar and wind additions, the future capacity includes existing independent power producers that may be repowered after the expiration of their power purchase agreement.

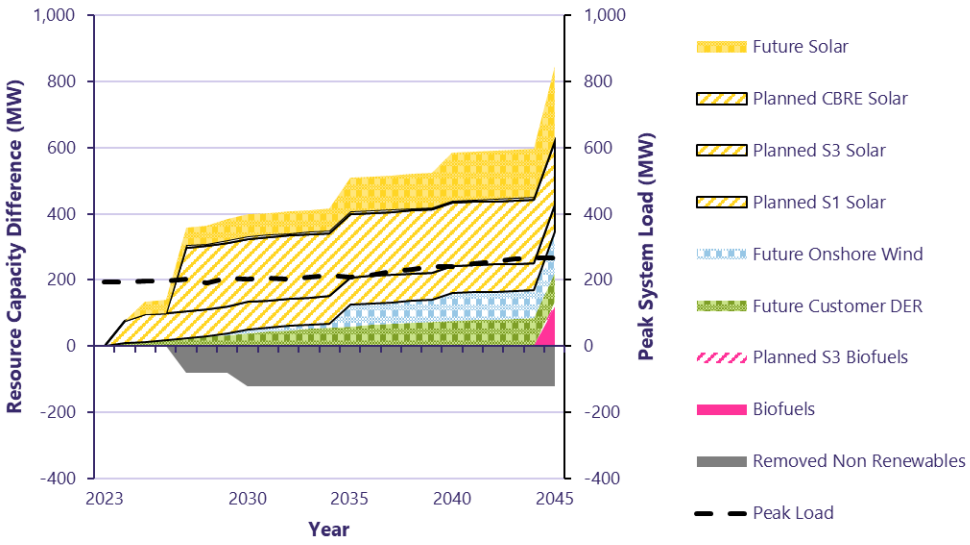

Figure 2-47. Maui: Preferred Plan change in installed capacity by resource type (2023–2045)

Figure 2-48 shows the installed capacity by resource in year 2030 for the Maui Preferred Plan.

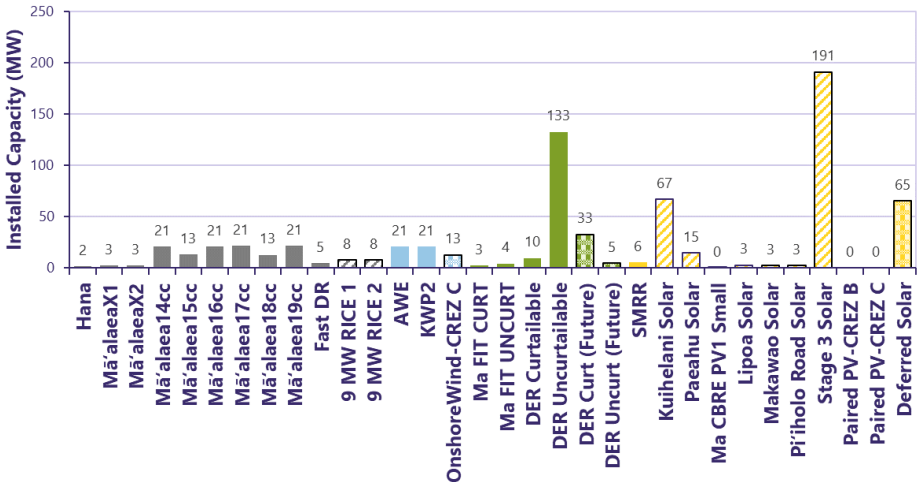

Figure 2-48. Maui: Preferred Plan installed capacity by resource (2030)

Figure 2-49 shows the installed capacity by resource in year 2035 for the Maui Preferred Plan.

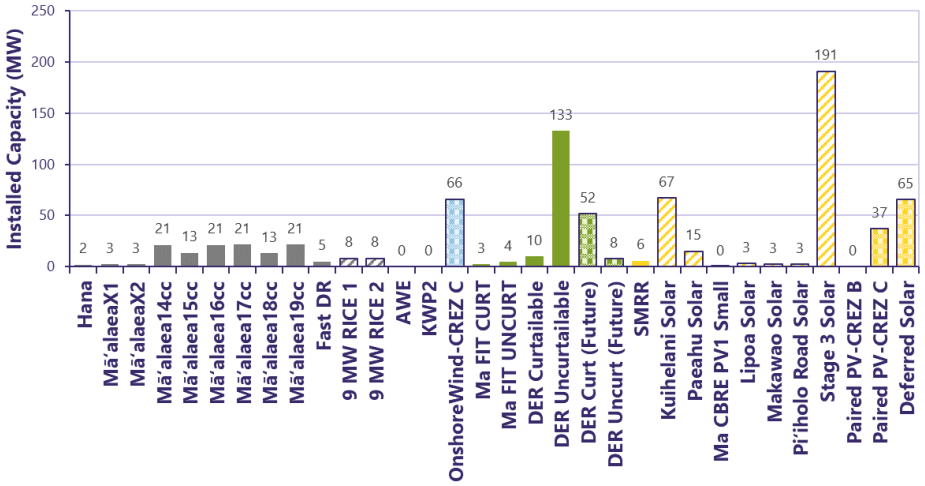

Figure 2-49. Maui: Preferred Plan installed capacity by resource (2035)

Figure 2-50 shows the installed capacity by resource in year 2040 for the Maui Preferred Plan.

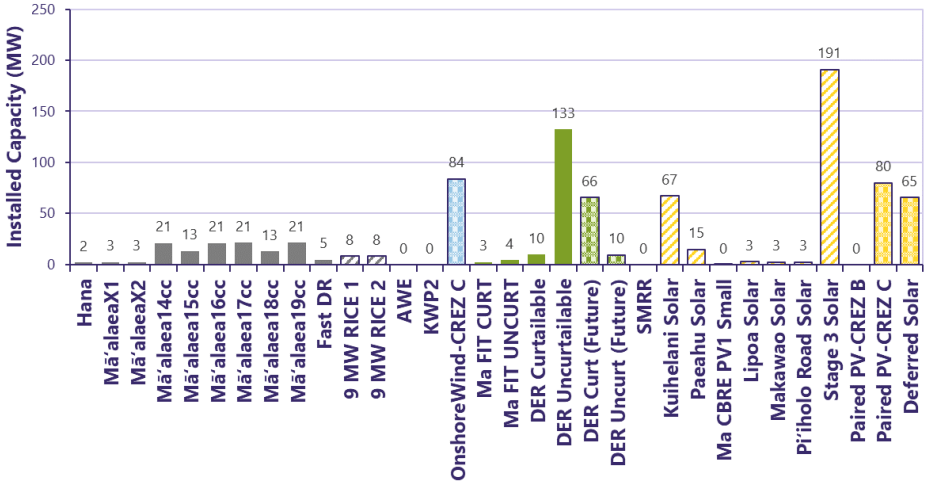

Figure 2-50. Maui: Preferred Plan installed capacity by resource (2040)

Figure 2-51 shows the installed capacity by resource in year 2045 for the Maui Preferred Plan.

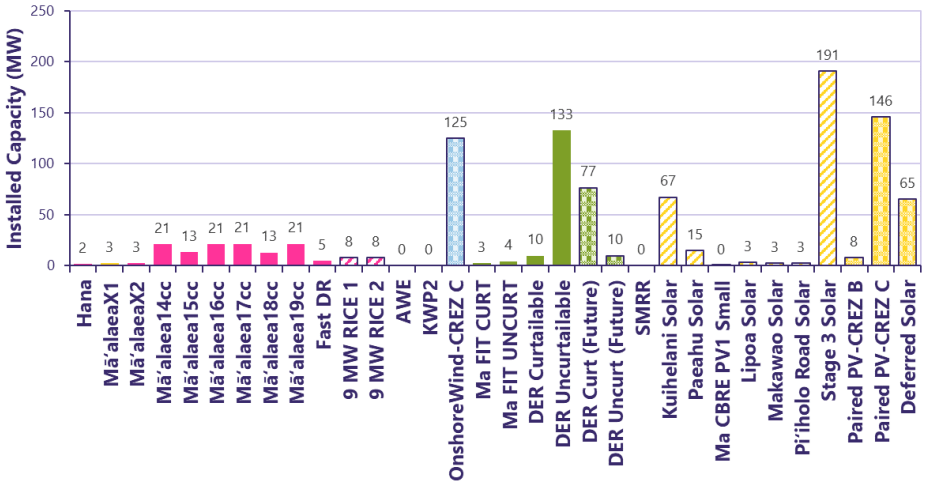

Figure 2-51. Maui: Preferred Plan installed capacity by resource (2045)

Figure 2-52 shows the generation by resource in year 2030 for the Maui Preferred Plan.

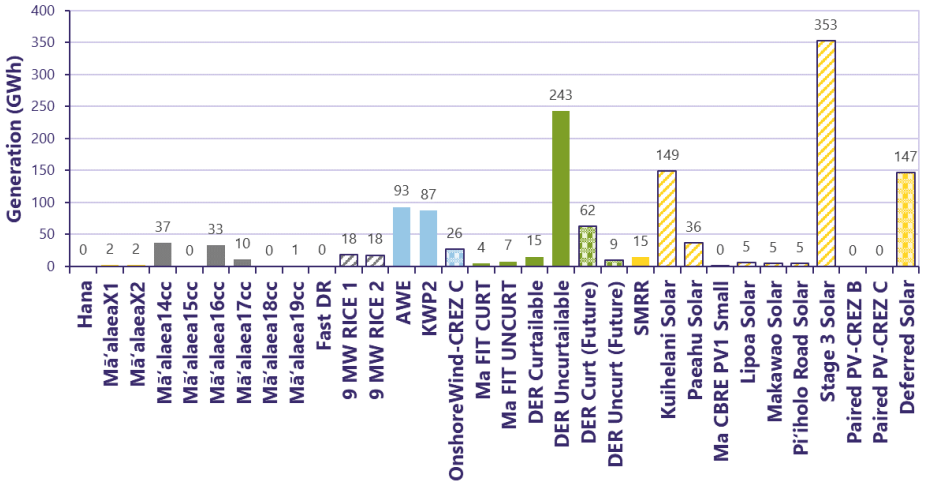

Figure 2-52. Maui: Preferred Plan generation by resource (2030)

Figure 2-53 shows the generation by resource in year 2035 for the Maui Preferred Plan.

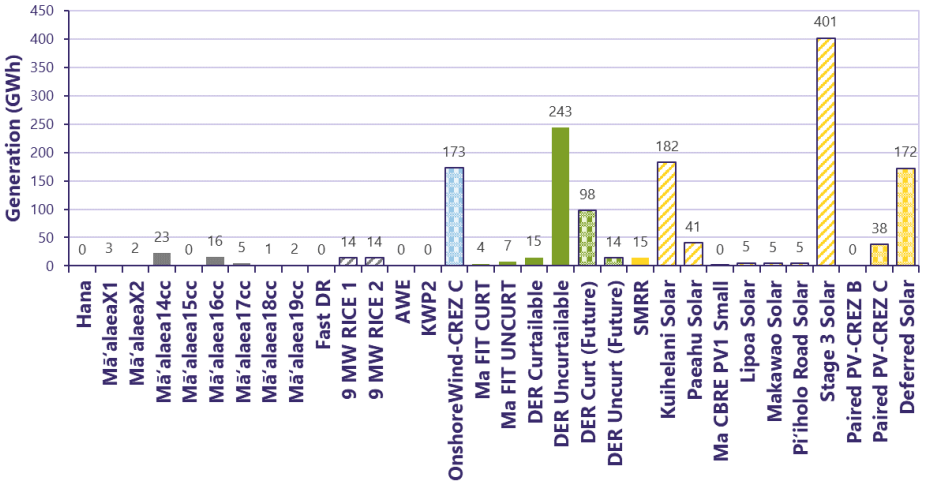

Figure 2-53. Maui: Preferred Plan generation by resource (2035)

Figure 2-54 shows the generation by resource in year 2040 for the Maui Preferred Plan.

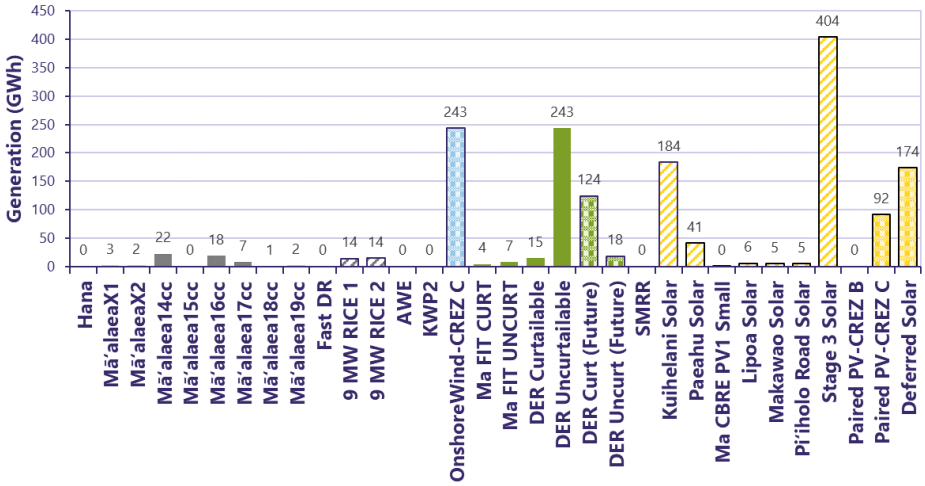

Figure 2-54. Maui: Preferred Plan generation by resource (2040)

Figure 2-55 shows the generation by resource in year 2045 for the Maui Preferred Plan.

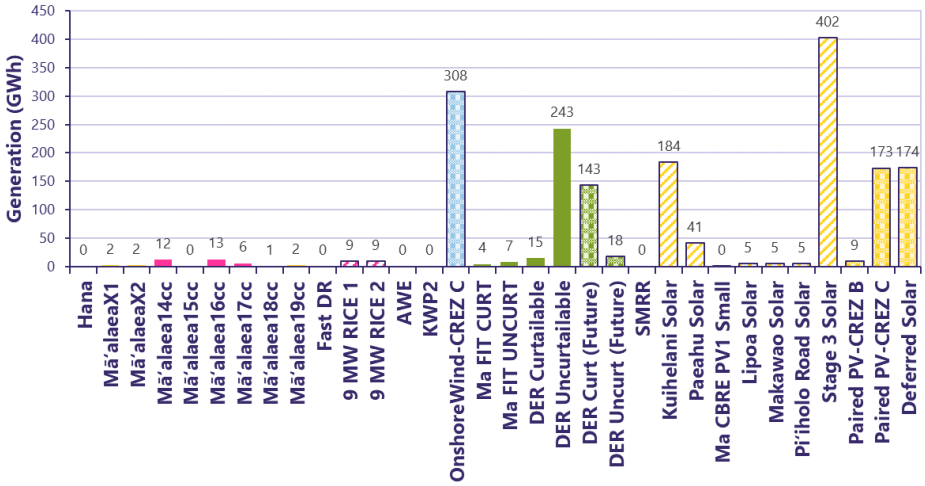

Figure 2-55. Maui: Preferred Plan generation by resource (2045)

Table 2-8 below summarizes the installed capacity and generation for each resource in the Maui Preferred Plan portfolio shown in the preceding figures. Each resource is accompanied by their full name or a brief description of the resource. In years where the installed capacity and generation are shown as zero, existing fossil fuel resources may be deactivated or their power purchase agreement expired.

Table 2-8. Maui: Preferred Plan installed capacity and generation by resource (2030, 2035, 2040, 2045)

Resource	Full Name / Description	Category	Installed Capacity (MW)				Generation (GWh)			
			2030	2035	2040	2045	2030	2035	2040	2045
Hana	Hana	Non-Renewables	1.9	1.9	1.9	1.9	0.1	0.1	0.1	0.1
Māʻalaea X1	Māʻalaea X1	Non-Renewables	2.5	2.5	2.5	2.5	2.3	2.7	2.5	1.8
Māʻalaea X2	Māʻalaea X2	Non-Renewables	2.5	2.5	2.5	2.5	2.2	2.4	2.5	1.8
Māʻalaea14cc	Māʻalaea14 Combustion Turbine	Non-Renewables	21.1	21.1	21.1	21.1	37.1	22.9	22.3	12.2
Māʻalaea15cc	Māʻalaea15 Steam Turbine	Non-Renewables	13.4	13.4	13.4	13.4	0.0	0.0	0.0	0.0
Māʻalaea16cc	Māʻalaea16 Combustion Turbine	Non-Renewables	21.1	21.1	21.1	21.1	32.8	16.1	18.3	12.6
Māʻalaea17cc	Māʻalaea17 Combustion Turbine	Non-Renewables	21.5	21.5	21.5	21.5	10.5	4.9	7.2	5.6
Māʻalaea18cc	Māʻalaea18 Steam Turbine	Non-Renewables	13.0	13.0	13.0	13.0	0.0	1.4	1.0	1.3
Māʻalaea19cc	Māʻalaea19 Combustion Turbine	Non-Renewables	21.5	21.5	21.5	21.5	1.2	2.2	2.4	2.3
Fast DR	Demand Response	Non-Renewables	4.9	4.9	4.9	4.9	0.1	0.1	0.2	0.2
9 MW RICE 1	Future Generator Candidate Resource 1	Non-Renewables	8.1	8.1	8.1	8.1	18.1	14.2	14.0	9.0
9 MW RICE 2	Future Generator Candidate Resource 2	Non-Renewables	8.1	8.1	8.1	8.1	17.6	14.3	14.4	8.8
AWE	Auahi Wind	Onshore Wind	21.0	0.0	0.0	0.0	92.9	0.0	0.0	0.0
KWP2	Kaheawa Wind 2	Onshore Wind	21.0	0.0	0.0	0.0	87.3	0.0	0.0	0.0
OnshoreWind-CREZ C	Future Onshore Wind Candidate Resource Zone C	Future Onshore Wind	13.0	66.0	84.0	125.0	26.4	172.7	243.2	308.2
Ma FIT CURT	Feed in Tariff Curtailable	Customer DER	2.5	2.5	2.5	2.5	4.2	4.2	4.2	4.2
Ma FIT UNCURT	Feed in Tariff Uncurtailable	Customer DER	4.4	4.4	4.4	4.4	7.5	7.5	7.5	7.5
DER Curtailable	Curtailable DER (2023 Levels)	Customer DER	9.8	9.8	9.8	9.8	15.1	15.1	15.1	15.1
DER Uncurtailable	Uncurtailable DER (2023 Levels)	Customer DER	132.7	132.7	132.7	132.7	243.2	243.2	243.2	243.2
DER Curt (Future)	Curtailable DER (above 2023 Levels)	Future Customer DER	33.0	51.8	65.9	76.7	62.4	97.7	124.0	143.3
DER Uncurt (Future)	Uncurtailable DER (above 2023 Levels)	Future Customer DER	5.1	7.7	9.5	9.8	9.3	14.2	18.0	18.0
SMRR	South Maui Renewable Resources, Kuia Solar	Solar	5.7	5.7	0.0	0.0	14.6	14.6	0.0	0.0
Kuihelani Solar	Kuihelani Solar	Planned S1 Solar	67.2	67.2	67.2	67.2	148.8	182.4	183.6	183.6
Paeahu Solar	Paeahu Solar	Planned S1 Solar	15.0	15.0	15.0	15.0	36.3	41.1	41.2	41.2
Ma CBRE PV1 Small	ROIZ CBRE	Planned CBRE Solar	0.03	0.03	0.03	0.03	0.1	0.1	0.1	0.1
Lipoa Solar	Lipoa Solar	Planned CBRE Solar	3.0	3.0	3.0	3.0	5.5	5.5	5.5	5.5
Makawao Solar	Makawao Solar	Planned CBRE Solar	2.5	2.5	2.5	2.5	4.6	4.6	4.6	4.6
Piʻiholo Road Solar	Piʻiholo Road Solar	Planned CBRE Solar	2.5	2.5	2.5	2.5	4.6	4.6	4.6	4.6
Stage 3 Solar	Stage 3 RFP Proxy Solar Resource	Planned S3 Solar	191.0	191.0	191.0	191.0	352.6	401.4	403.7	402.5
Paired PV-CREZ B	Future Solar Candidate Resource Zone B	Future Solar	0.0	0.0	0.0	8.0	0.0	0.0	0.0	9.0
Paired PV-CREZ C	Future Solar Candidate Resource Zone C	Future Solar	0.0	37.0	80.0	146.0	0.0	37.9	91.7	173.3
Deferred Solar	Difference in pre-Stage 3 procurement targets and actual procurements	Future Solar	65.5	65.5	65.5	65.5	146.8	172.0	173.7	174.3

Due to modeled projects that have withdrawn or program targets that have not been fulfilled, approximately 66 MW of additional solar resources are needed to meet Maui's Preferred Plan for 2030. This deferred solar capacity is due to CBRE program target shortfalls and the withdrawal of Kamaole Solar.

The Stage 3 RFP process is still ongoing and will have a significant impact on whether near-term reliability can be met, depending on the quantity, size, resource type and timing of proposals selected in the final award group, and if those proposals reach commercial operations. By 2030, 191 MW of new hybrid solar resources were assumed to be procured through the Stage 3 RFP.

Figure 2-56 and Figure 2-57 illustrate the capacity and energy by technology that is included in the Maui Preferred Plan.

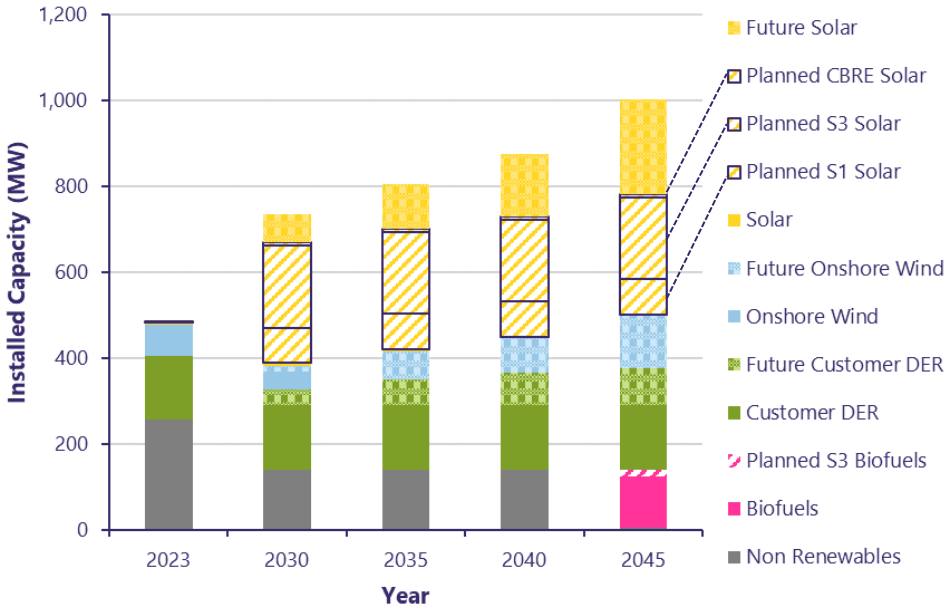

Figure 2-56. Maui: Preferred Plan installed capacity by resource type (2023–2045)

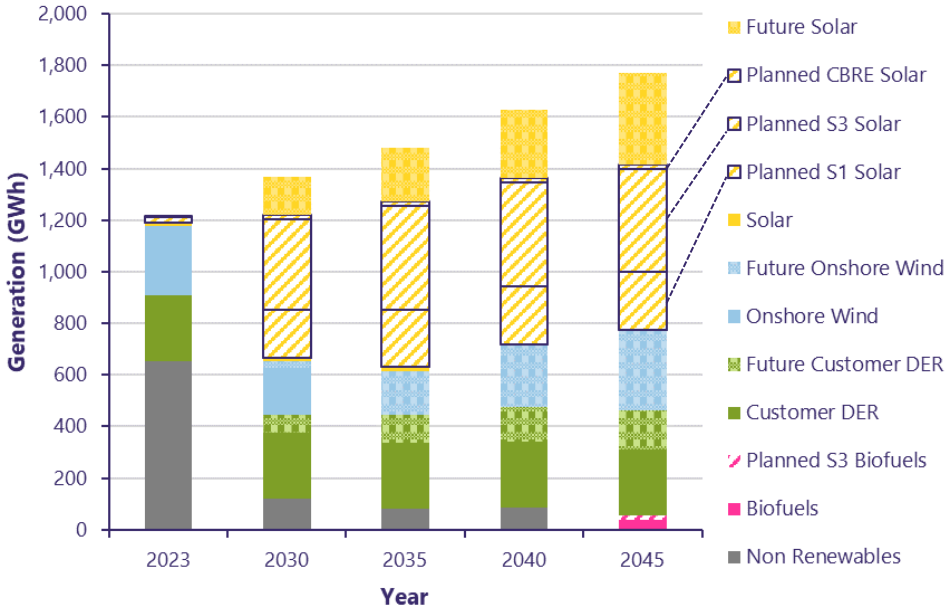

Figure 2-57. Maui: Preferred Plan generation by resource type (2023–2045)

Maui resource adequacy needs were evaluated under other scenarios in Sections 8.4.2, 12.3.3 and Appendix C to address:

- Higher than expected loads
- Deactivation of more or less existing firm generation depending on the amount of new resources that can be installed in the near term
- Incremental additions of hybrid solar resources
- Incremental additions of firm resources

In Table 12-9 in Section 12.3.3, under the 2030 base load, we show that a 0.1 loss of load expectation can be met with the addition of new firm and hybrid solar resources through the Stage 3 RFP. However, in Table 12-10, we show that the Maui system is very sensitive to a high load where the Stage 3 RFP targets for variable and firm renewables must be exceeded to meet a 0.1 loss of load expectation where up to 81 MW of new firm and 294 MW of new variable renewable resources would be needed.

In addition to generation needs, the system security study in Appendix D of the Integrated Grid Plan evaluated Maui steady-state (i.e., transmission network expansion and renewable energy zone enablement) and dynamic stability transmission system needs under base and high load resource plans. . Maui transmission system upgrade and renewable energy zone enablement costs are summarized in Table 2-9. When modeling the high load resource plan, additional network expansion and renewable energy zone enablement mitigations and costs were identified for compared to the Preferred Plan.

Table 2-9. Maui transmission needs cost estimate in million dollars by studied years (2027, 2035, 2040, 2045 and 2050)

Category	Preferred Plan (Base)					High Load Resource Plan		
	2027	2035	2040	2045	2050	2027	2030	2035
Transmission Networks Expansion	13.1	96.1	51.9	164.7	123.1	31.4	140.1	60.7
REZ Enablement	0	19.3	15.6	15.5	18	0	13.7	22.1

2.4 Moloka‘i

The pie and stacked area charts below provide the capacity and energy for the Moloka‘i Preferred Plan using the results of the Moloka‘i base scenario.

Figure 2-58 shows the generation by resource type in key years over the planning horizon for the Moloka‘i Preferred Plan.

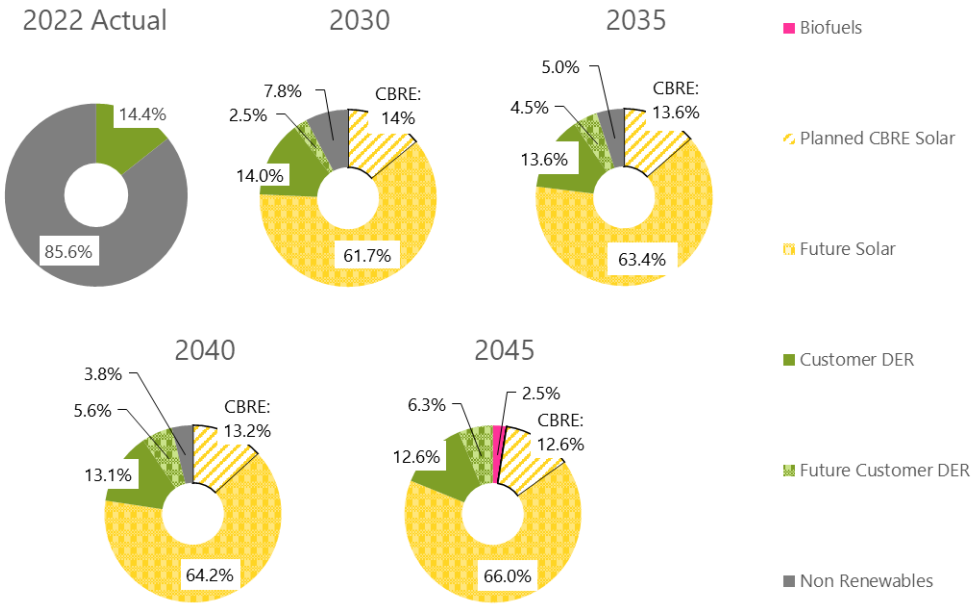

Figure 2-58. Preferred Plan generation mix: Moloka‘i

Figure 2-59 shows the change in capacity over time for the Moloka‘i Preferred Plan.

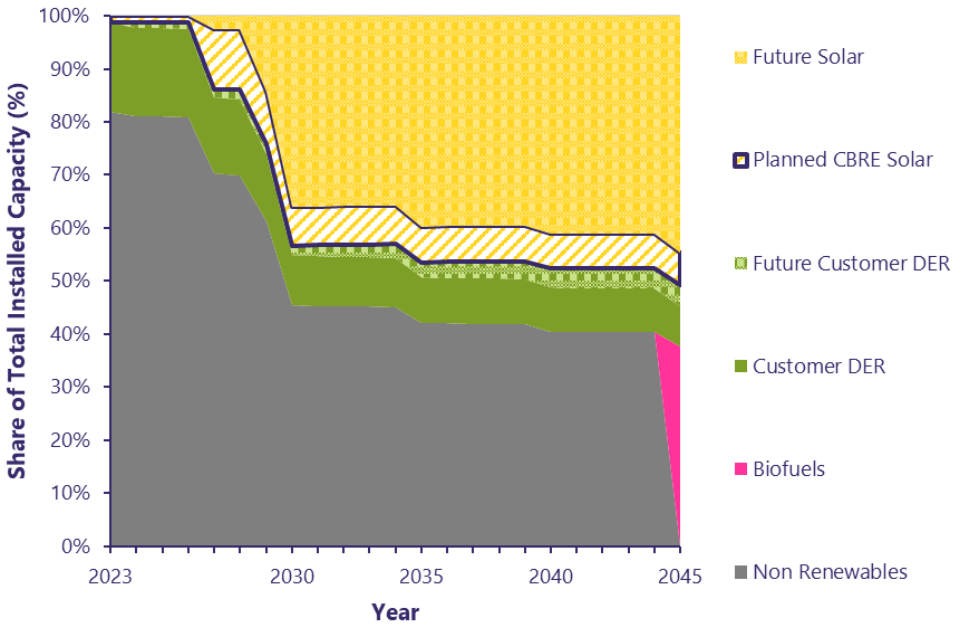

Figure 2-59. Moloka‘i: Preferred Plan resource installed capacity mix (2023–2045)

Figure 2-60 shows the change in generation over time for the Moloka'i Preferred Plan.

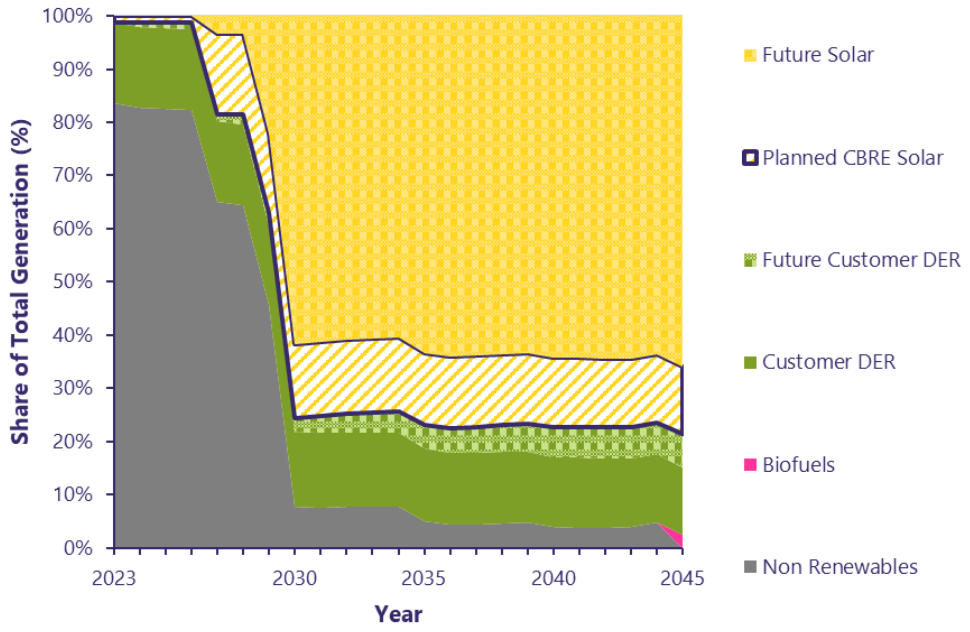

Figure 2-60. Moloka'i: Preferred Plan resource generation mix (2023–2045)

Figure 2-61 shows the incremental change in capacity for the Moloka'i Preferred Plan.

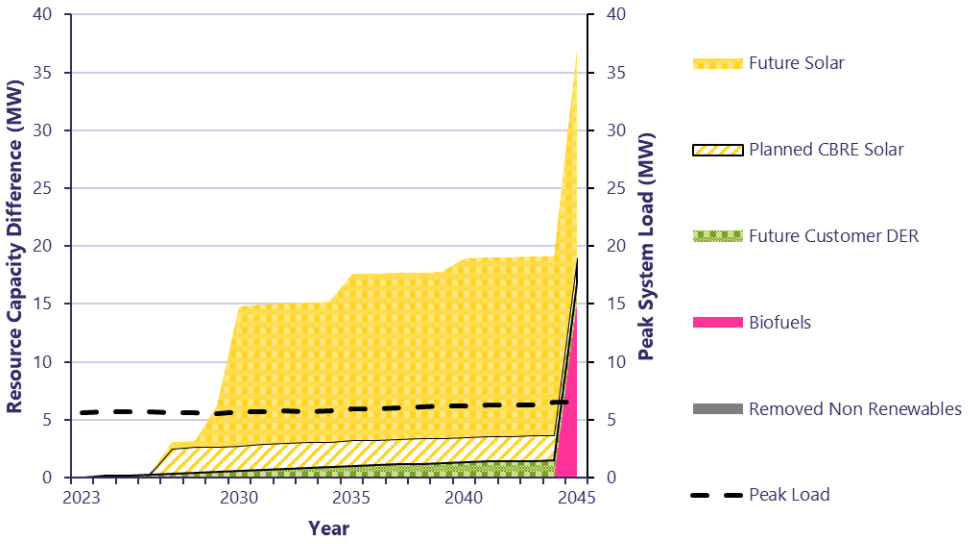

Figure 2-61. Moloka'i: Preferred Plan change in installed capacity by resource type (2023–2045)

Figure 2-62 shows the installed capacity by resource in year 2030 for the Moloka'i Preferred Plan.

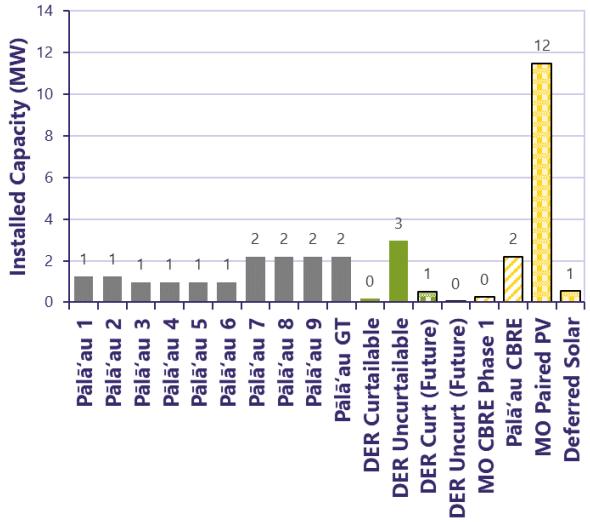

Figure 2-62. Moloka'i: Preferred Plan installed capacity by resource (2030)

Figure 2-63 shows the installed capacity by resource in year 2035 for the Moloka'i Preferred Plan.

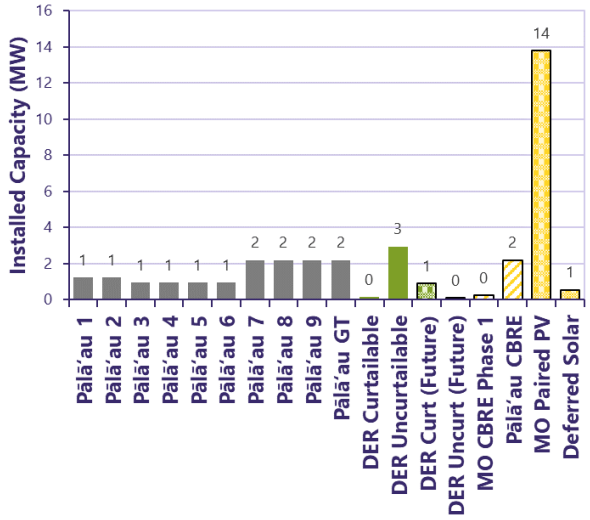

Figure 2-63. Moloka'i: Preferred Plan installed capacity by resource (2035)

Figure 2-64 shows the installed capacity by resource in year 2040 for the Moloka'i Preferred Plan.

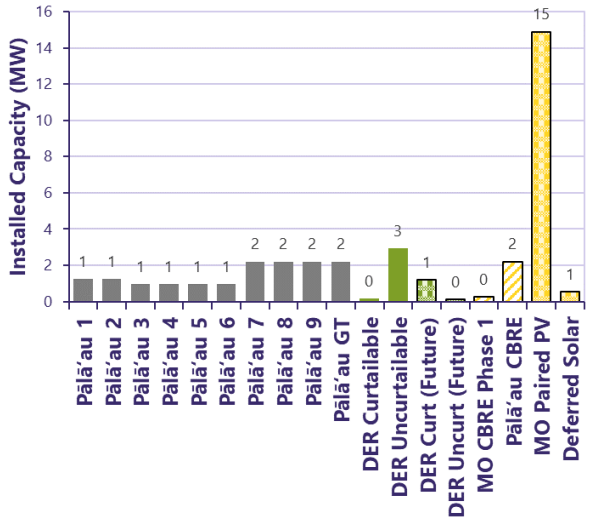

Figure 2-64. Moloka'i: Preferred Plan installed capacity by resource (2040)

Figure 2-65 shows the installed capacity by resource in year 2045 for the Moloka'i Preferred Plan.

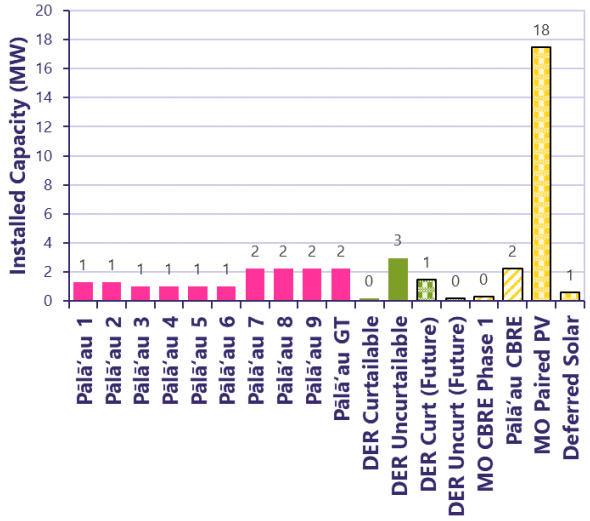

Figure 2-65. Moloka'i: Preferred Plan installed capacity by resource (2045)

Figure 2-66 shows the generation by resource in year 2030 for the Moloka'i Preferred Plan.

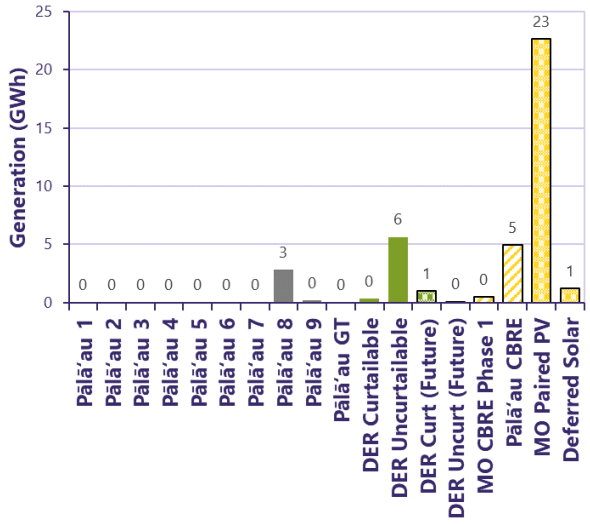

Figure 2-66. Moloka'i: Preferred Plan generation by resource (2030)

Figure 2-67 shows the generation by resource in year 2035 for the Moloka'i Preferred Plan.

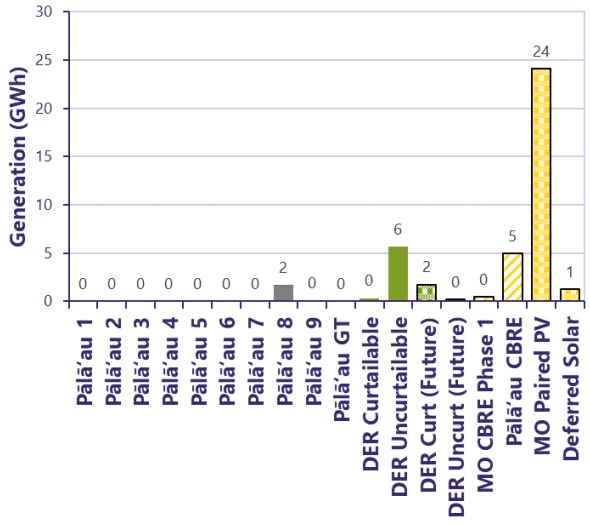

Figure 2-67. Moloka'i: Preferred Plan generation by resource (2035)

Figure 2-68 shows the generation by resource in year 2040 for the Moloka'i Preferred Plan.

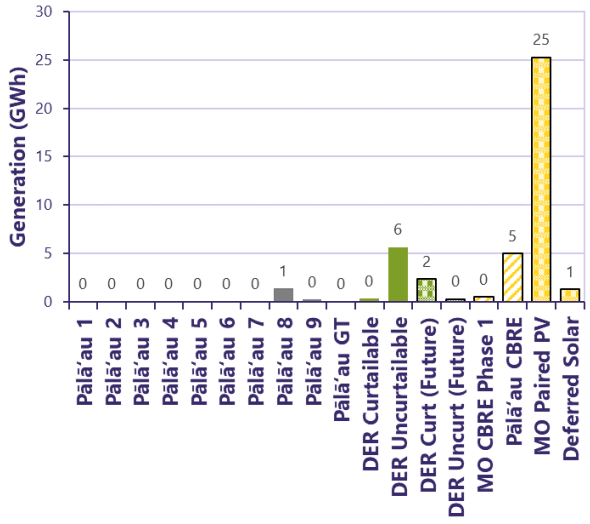

Figure 2-68. Moloka'i: Preferred Plan generation by resource (2040)

Figure 2-69 shows the generation by resource in year 2045 for the Moloka'i Preferred Plan.

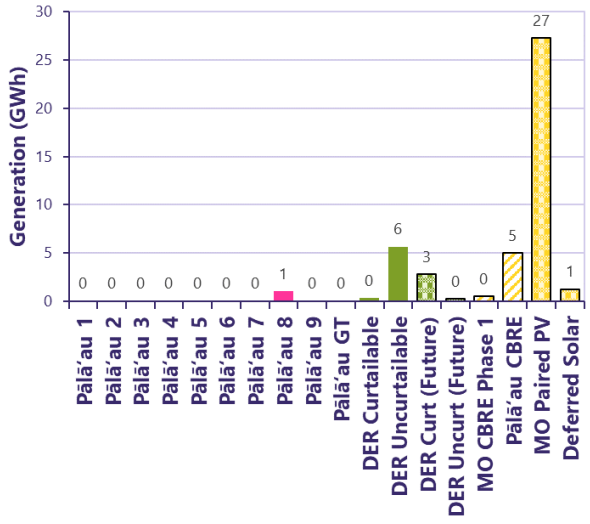

Figure 2-69. Moloka'i: Preferred Plan generation by resource (2045)

Table 2-10 below summarizes the installed capacity and generation for each resource in the Moloka'i Preferred Plan portfolio shown in the preceding figures. Each resource is accompanied by their full name or a brief description of the resource. In years where the installed capacity and generation are shown as zero, existing fossil fuel resources may be deactivated or their power purchase agreement expired.

Table 2-10. Moloka'i: Preferred Plan installed capacity and generation by resource (2030, 2035, 2040, 2045)

Resource	Full Name / Description	Category	Installed Capacity (MW)				Generation (GWh)			
			2030	2035	2040	2045	2030	2035	2040	2045
Pālā'au 1	Pālā'au 1	Non-Renewables	1.25	1.25	1.25	1.25	0.00	0.01	0.00	0.00
Pālā'au 2	Pālā'au 2	Non-Renewables	1.25	1.25	1.25	1.25	0.00	0.01	0.00	0.01
Pālā'au 3	Pālā'au 3	Non-Renewables	0.97	0.97	0.97	0.97	0.00	0.01	0.00	0.00
Pālā'au 4	Pālā'au 4	Non-Renewables	0.97	0.97	0.97	0.97	0.00	0.01	0.00	0.00
Pālā'au 5	Pālā'au 5	Non-Renewables	0.97	0.97	0.97	0.97	0.00	0.01	0.00	0.00
Pālā'au 6	Pālā'au 6	Non-Renewables	0.97	0.97	0.97	0.97	0.01	0.03	0.01	0.00
Pālā'au 7	Pālā'au 7	Non-Renewables	2.20	2.20	2.20	2.20	0.01	0.03	0.00	0.00
Pālā'au 8	Pālā'au 8	Non-Renewables	2.20	2.20	2.20	2.20	2.82	1.73	1.36	1.01
Pālā'au 9	Pālā'au 9	Non-Renewables	2.20	2.20	2.20	2.20	0.19	0.12	0.22	0.06
Pālā'au GT	Pālā'au GT	Non-Renewables	2.20	2.20	2.20	2.20	0.00	0.05	0.00	0.00
DER Curtailable	Curtailable DER (2023 Levels)	Customer DER	0.17	0.17	0.17	0.17	0.33	0.33	0.33	0.33
DER Uncurtailable	Uncurtailable DER (2023 Levels)	Customer DER	2.95	2.95	2.95	2.95	5.64	5.64	5.64	5.64
DER Curt (Future)	Curtailable DER (above 2023 Levels)	Future Customer DER	0.52	0.92	1.21	1.45	0.98	1.75	2.31	2.76
DER Uncurt (Future)	Uncurtailable DER (above 2023 Levels)	Future Customer DER	0.05	0.12	0.12	0.13	0.08	0.22	0.25	0.24
MO CBRE Phase 1	Kualapu'u CBRE	Planned CBRE Solar	0.25	0.25	0.25	0.25	0.48	0.48	0.48	0.48
Pālā'au CBRE	Pālā'au CBRE	Planned CBRE Solar	2.20	2.20	2.20	2.20	4.96	4.96	4.97	4.96
MO Paired PV	Future Solar Candidate Resource	Future Solar	11.50	13.80	14.90	17.50	22.65	24.12	25.28	27.27
Deferred Solar	Difference in pre-Stage 3 procurement targets and actual procurements	Future Solar	0.55	0.55	0.55	0.55	1.24	1.24	1.24	1.24

Figure 2-70 and Figure 2-71 illustrate the capacity and energy by technology that is included in the Moloka'i Preferred Plan.

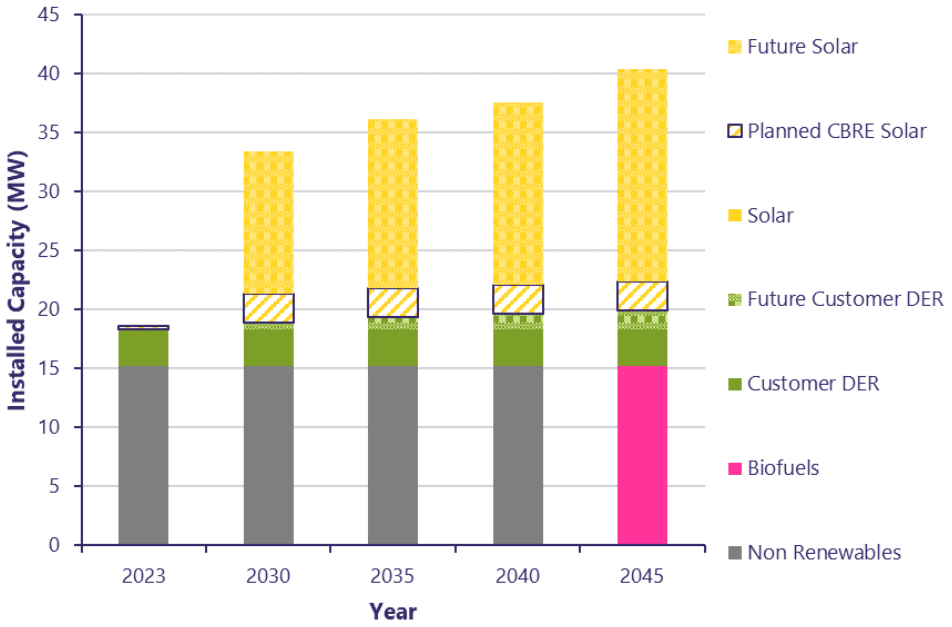

Figure 2-70. Moloka'i: Preferred Plan installed capacity by resource type (2023–2045)

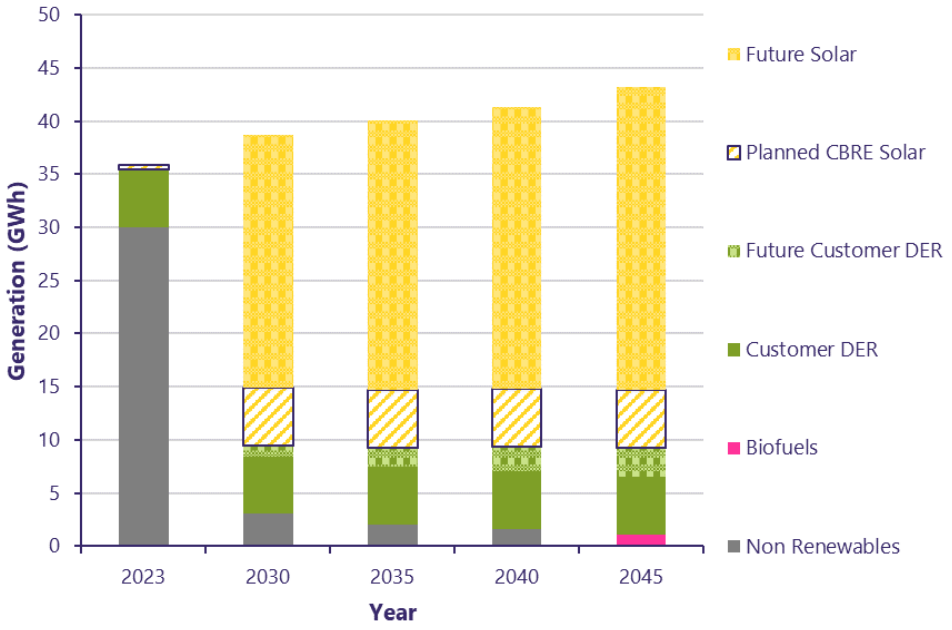

Figure 2-71. Moloka'i: Preferred Plan generation by resource type (2023–2045)

Moloka'i resource adequacy needs were evaluated under other scenarios in Sections 8.5.2, 12.3.4 and Appendix C to address:

- Higher than expected loads
- Deactivation of more existing firm generation depending on the amount of new resources that can be installed in the near term
- Incremental additions of hybrid solar resources
- Incremental additions of firm resources

In Table 12-11 in Section 12.3.4, under the 2030 base load, we show that a 0.1 loss of load expectation can be met with the addition of new hybrid solar resources. However, we also show that if some of the existing firm generators were deactivated, more new hybrid solar would be needed than new firm resources to meet 0.1 loss of load expectation.

In addition to generation needs, the system security study in Appendix D of the Integrated Grid Plan evaluated Moloka'i transmission needs under base and high load scenarios. Based on the relatively large system resources connected to the power plant bus, stability needs were not identified during the study horizon.

2.5 Lānaʻi

The pie and stacked area charts below provide the capacity and energy for the Lānaʻi Preferred Plan using the results of the Lānaʻi base scenario.

Figure 2-72 shows the generation by resource type in key years over the planning horizon for the Molokaʻi Preferred Plan.

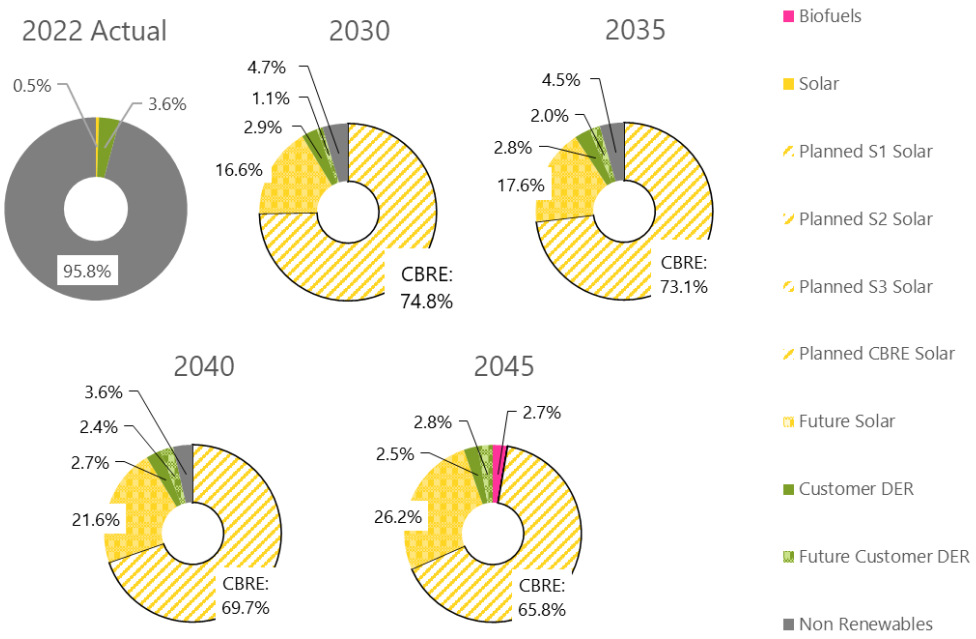

Figure 2-72. Preferred Plan generation mix: Lānaʻi

Figure 2-73 shows the change in capacity over time for the Lānaʻi Preferred Plan.

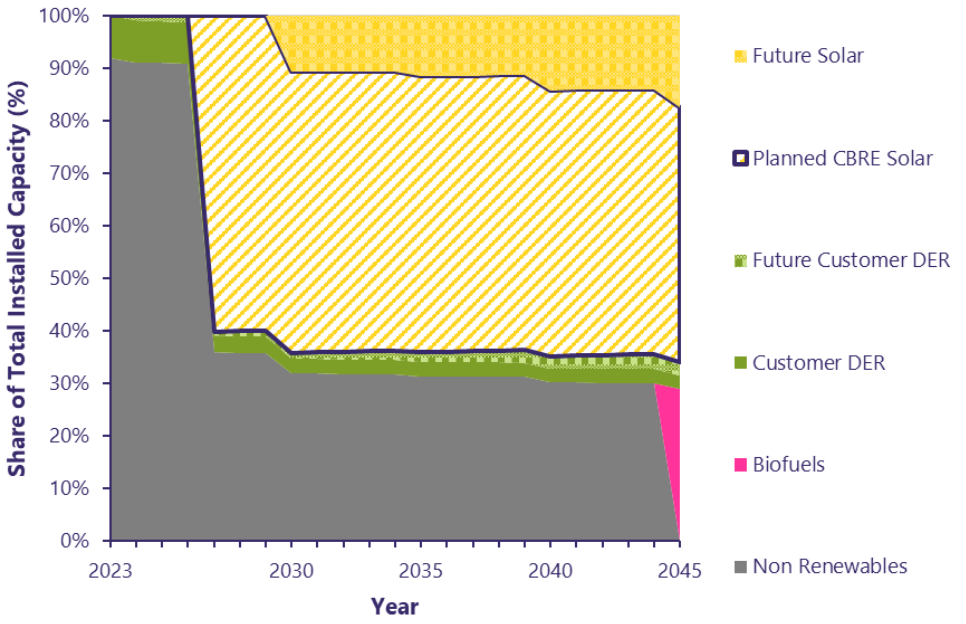

Figure 2-73. Lānaʻi: Preferred Plan resource installed capacity mix (2023–2045)

Figure 2-74 shows the change in generation over time for the Lānaʻi Preferred Plan.

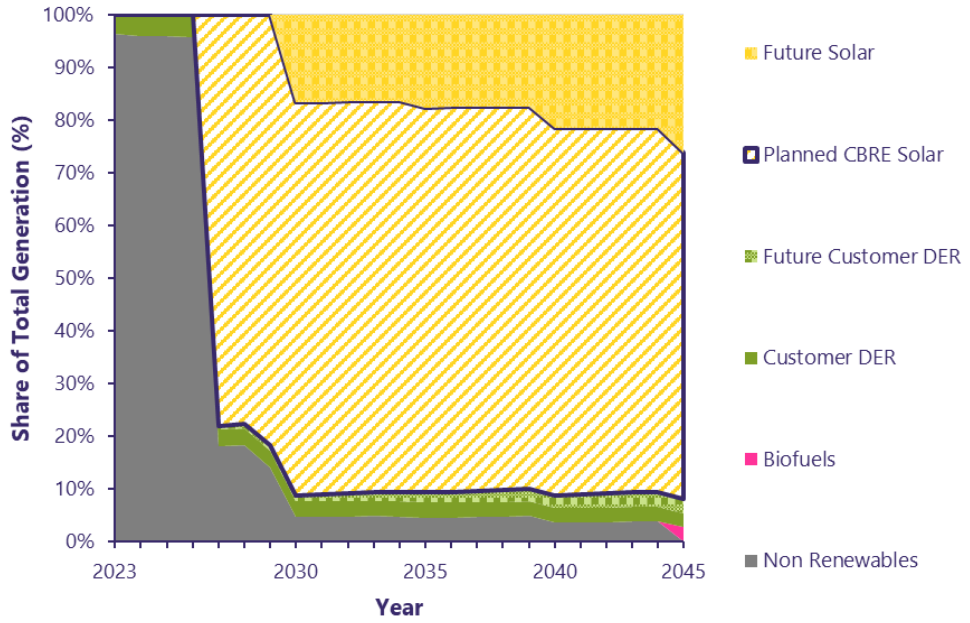

Figure 2-74. Lānaʻi: Preferred Plan resource generation mix (2023–2045)

Figure 2-75 shows the incremental change in capacity for the Lānaʻi Preferred Plan.

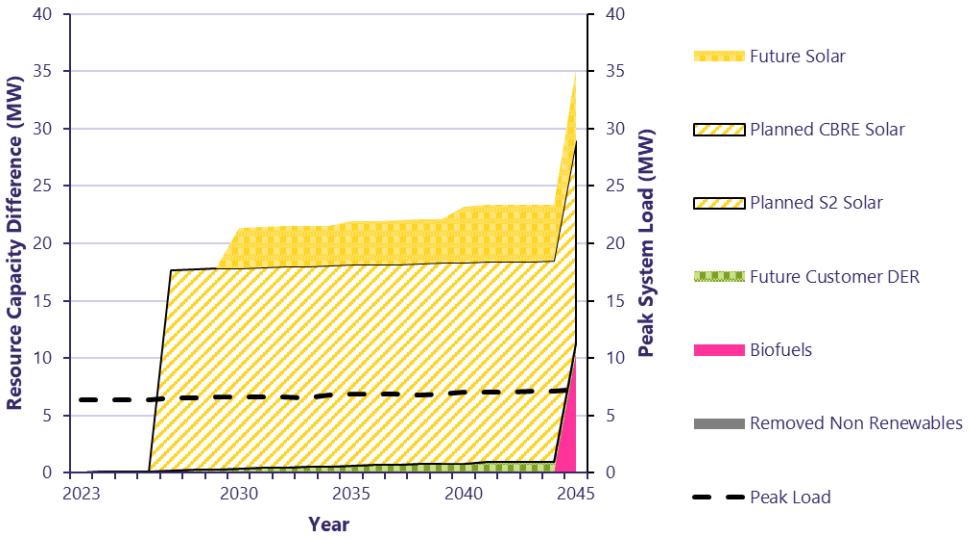

Figure 2-75. Lānaʻi: Preferred Plan change in installed capacity by resource type (2023–2045)

Figure 2-76 shows the installed capacity by resource in year 2030 for the Lāna'i Preferred Plan.

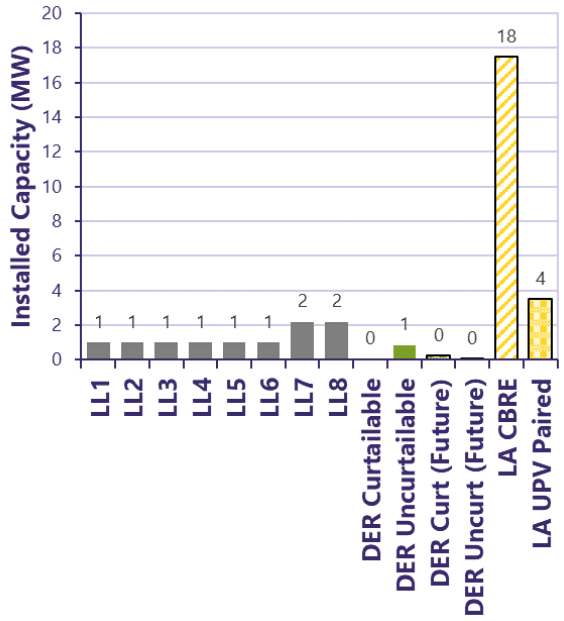

Figure 2-76. Lāna'i: Preferred Plan installed capacity by resource (2030)

Figure 2-77 shows the installed capacity by resource in year 2035 for the Lāna'i Preferred Plan.

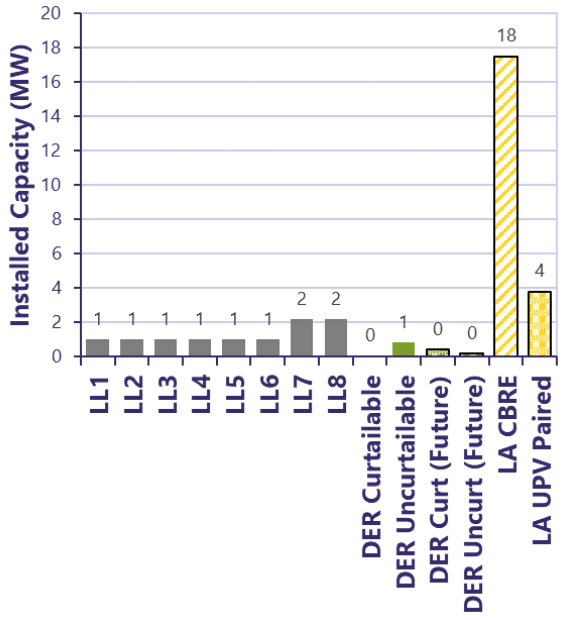

Figure 2-77. Lāna'i: Preferred Plan installed capacity by resource (2035)

Figure 2-78 shows the installed capacity by resource in year 2040 for the Lāna'i Preferred Plan.

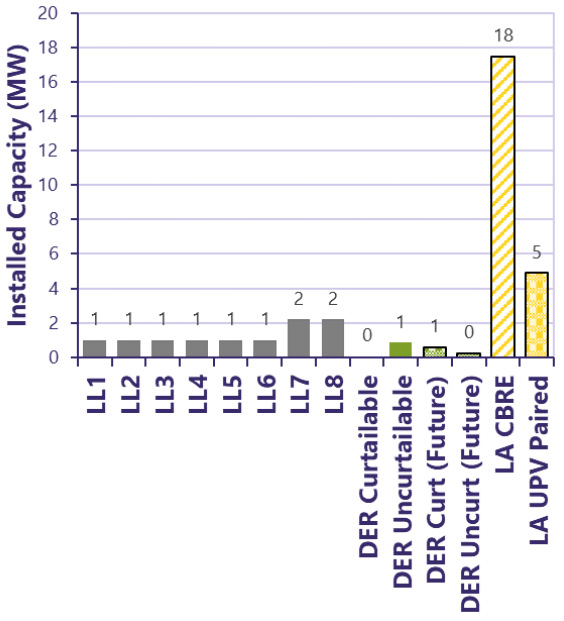

Figure 2-78. Lāna'i: Preferred Plan installed capacity by resource (2040)

Figure 2-79 shows the installed capacity by resource in year 2045 for the Lāna'i Preferred Plan.

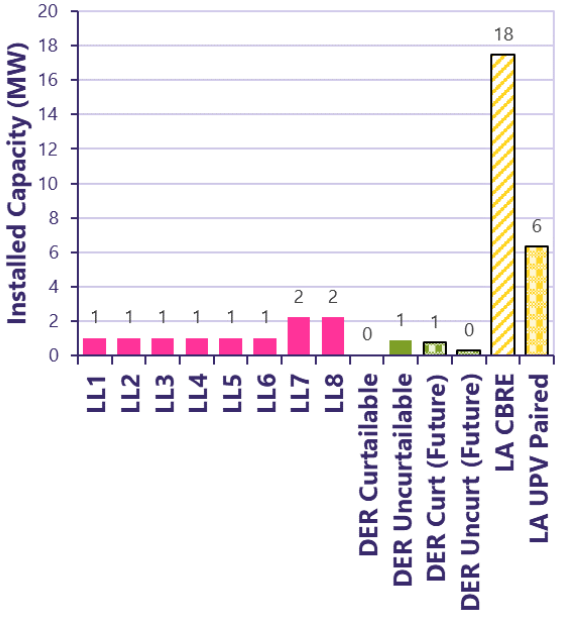

Figure 2-79. Lāna'i: Preferred Plan installed capacity by resource (2045)

Figure 2-80 shows the generation by resource in year 2030 for the Lāna'i Preferred Plan.

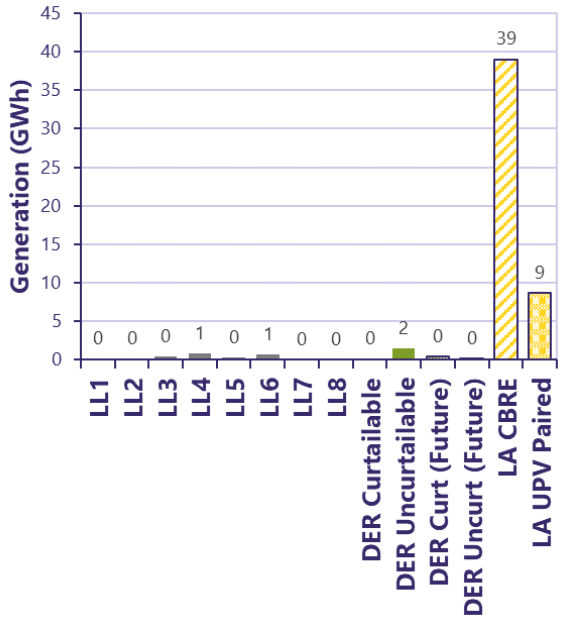

Figure 2-80. Lāna'i: Preferred Plan generation by resource (2030)

Figure 2-81 shows the generation by resource in year 2035 for the Lāna'i Preferred Plan.

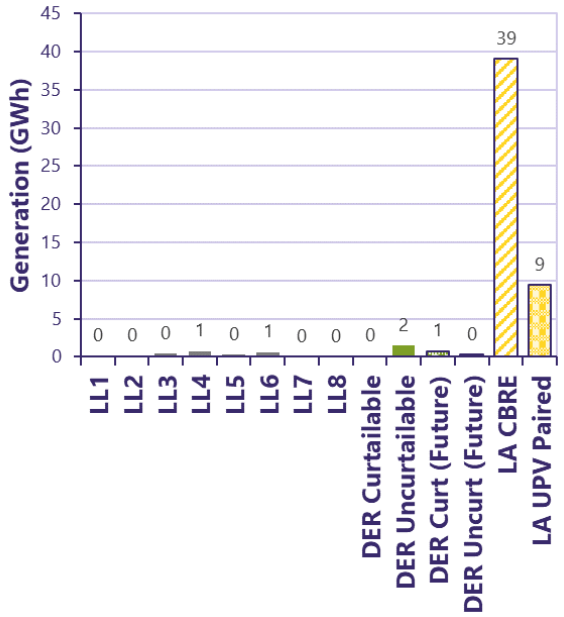

Figure 2-81. Lāna'i: Preferred Plan generation by resource (2035)

Figure 2-82 shows the generation by resource in year 2040 for the Lāna'i Preferred Plan.

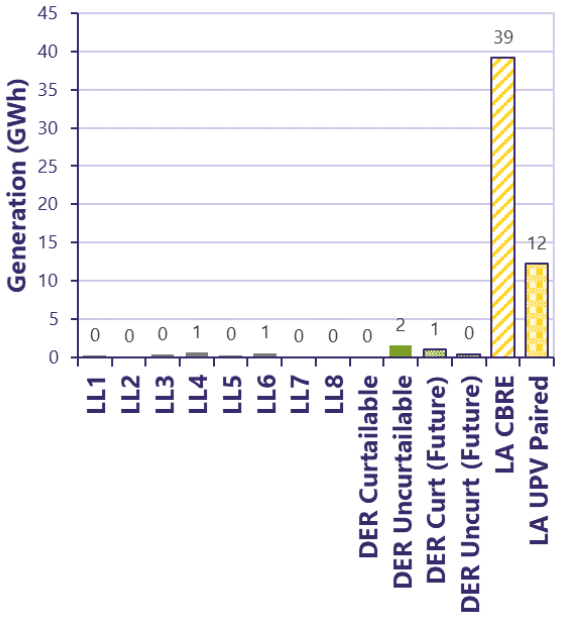

Figure 2-82. Lāna'i: Preferred Plan generation by resource (2040)

Figure 2-83 shows the generation by resource in year 2045 for the Lāna'i Preferred Plan.

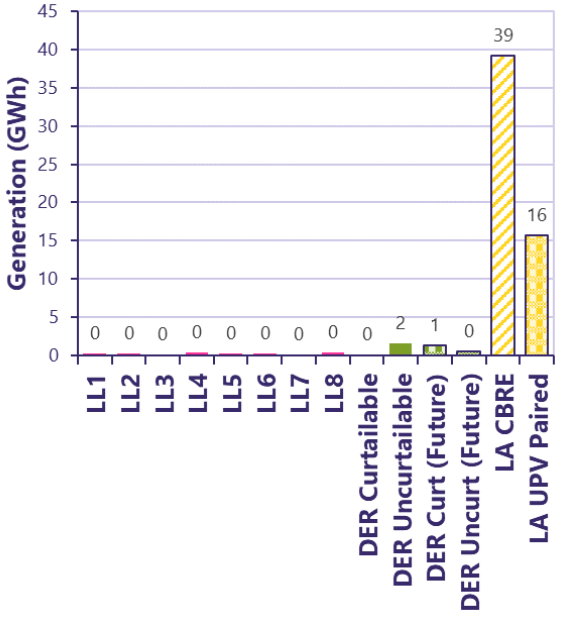

Figure 2-83. Lāna'i: Preferred Plan generation by resource (2045)

Table 2-11 below summarizes the installed capacity and generation for each resource in the Lānaʻi Preferred Plan portfolio shown in the preceding figures. Each resource is accompanied by their full name or a brief description of the resource. In years where the installed capacity and generation are shown as zero, existing fossil fuel resources may be deactivated or their power purchase agreement expired.

Table 2-11. Lānaʻi: Preferred Plan installed capacity and generation by resource (2030, 2035, 2040, 2045)

Resource	Full Name / Description	Category	Installed Capacity (MW)				Generation (GWh)			
			2030	2035	2040	2045	2030	2035	2040	2045
LL1	Lānaʻi 1	Non-Renewables	1.00	1.00	1.00	1.00	0.17	0.19	0.20	0.19
LL2	Lānaʻi 2	Non-Renewables	1.00	1.00	1.00	1.00	0.11	0.09	0.00	0.18
LL3	Lānaʻi 3	Non-Renewables	1.00	1.00	1.00	1.00	0.45	0.43	0.36	0.12
LL4	Lānaʻi 4	Non-Renewables	1.00	1.00	1.00	1.00	0.80	0.78	0.62	0.32
LL5	Lānaʻi 5	Non-Renewables	1.00	1.00	1.00	1.00	0.25	0.27	0.25	0.17
LL6	Lānaʻi 6	Non-Renewables	1.00	1.00	1.00	1.00	0.64	0.62	0.51	0.21
LL7	Lānaʻi 7	Non-Renewables	2.20	2.20	2.20	2.20	0.00	0.00	0.00	0.06
LL8	Lānaʻi 8	Non-Renewables	2.20	2.20	2.20	2.20	0.01	0.00	0.06	0.35
DER Curtailable	Curtailable DER (2023 Levels)	Customer DER	0.05	0.05	0.05	0.05	0.09	0.09	0.09	0.09
DER Uncurtailable	Uncurtailable DER (2023 Levels)	Customer DER	0.86	0.86	0.86	0.86	1.50	1.50	1.50	1.50
DER Curt (Future)	Curtailable DER (above 2023 Levels)	Future Customer DER	0.25	0.44	0.58	0.73	0.43	0.77	1.02	1.26
DER Uncurt (Future)	Uncurtailable DER (above 2023 Levels)	Future Customer DER	0.09	0.19	0.23	0.26	0.16	0.34	0.40	0.46
LA CBRE	Lānaʻi CBRE	Planned CBRE Solar	17.50	17.50	17.50	17.50	39.00	39.05	39.23	39.24
LA UPV Paired	Future Solar Candidate Resource	Future Solar	3.51	3.81	4.91	6.31	8.66	9.41	12.18	15.66

Figure 2-84 and Figure 2-85 illustrate the capacity and energy by technology that is included in the Lānaʻi Preferred Plan.

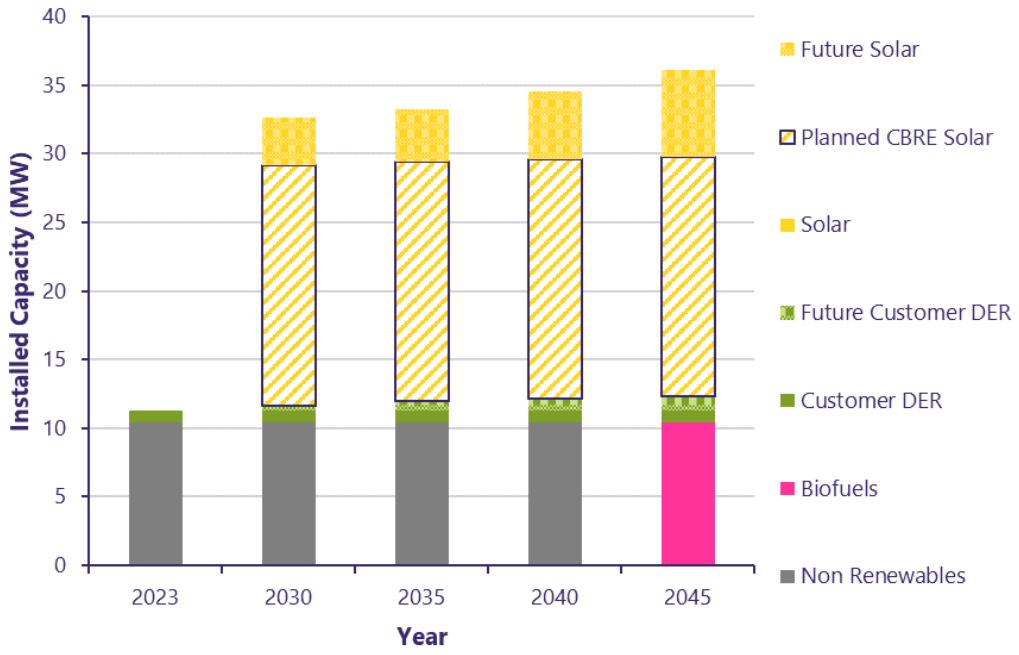

Figure 2-84. Lānaʻi: Preferred Plan installed capacity by resource type (2023–2045)

Figure 2-85. Lānaʻi: Preferred Plan generation by resource type (2023–2045)

Lāna'i resource adequacy needs were evaluated under other scenarios in Sections 8.6.2, 12.3.5 and Appendix C to address:

- Higher than expected loads
- Deactivation of more existing firm generation depending on the amount of new resources that can be installed in the near term
- Incremental additions of hybrid solar resources
- Incremental additions of firm resources

In Table 12-13 in Section 12.3.5, under the 2030 base load, we show that a 0.1 loss of load expectation can be met with the addition of new hybrid solar resources. However, we also show that if some of the existing firm generators were deactivated, more new hybrid solar would be needed than new firm resources to meet 0.1 loss of load expectation.

In addition to generation needs, the system security study in Appendix D of the Integrated Grid Plan evaluated Lāna'i transmission needs under base and high load scenarios. Based on the relatively large system resources connected to the power plant bus, stability needs were not identified during the study horizon.

2.6 Consolidated

The pie and stacked area charts below provide the consolidated capacity and energy for the Preferred Plans on all islands.

Figure 2-86 shows the generation by resource type in key years over the planning horizon for all islands.

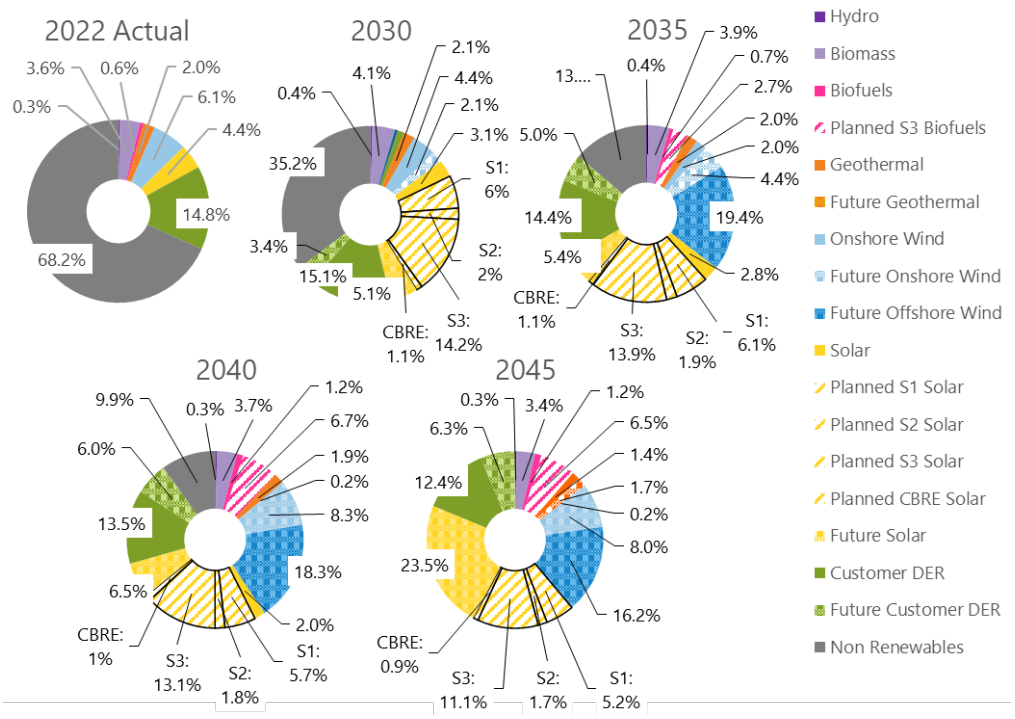

Figure 2-86. Preferred Plan generation mix: Consolidated

Figure 2-87 shows the change in capacity over time for the Consolidated Preferred Plan.

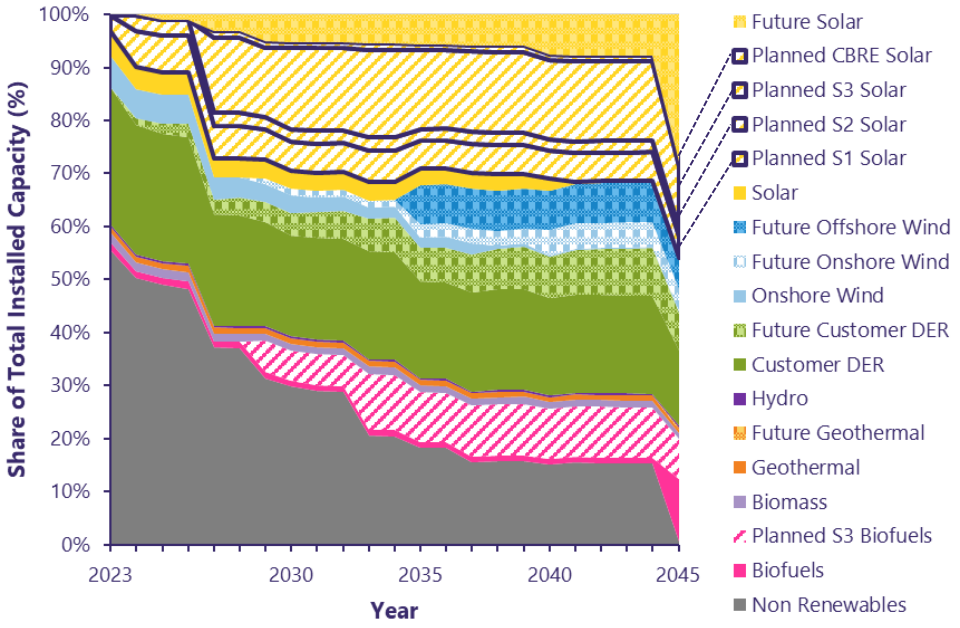

Figure 2-87. Consolidated: Preferred Plan resource installed capacity mix (2023–2045)

Figure 2-88 shows the change in generation over time for the Consolidated Preferred Plan.

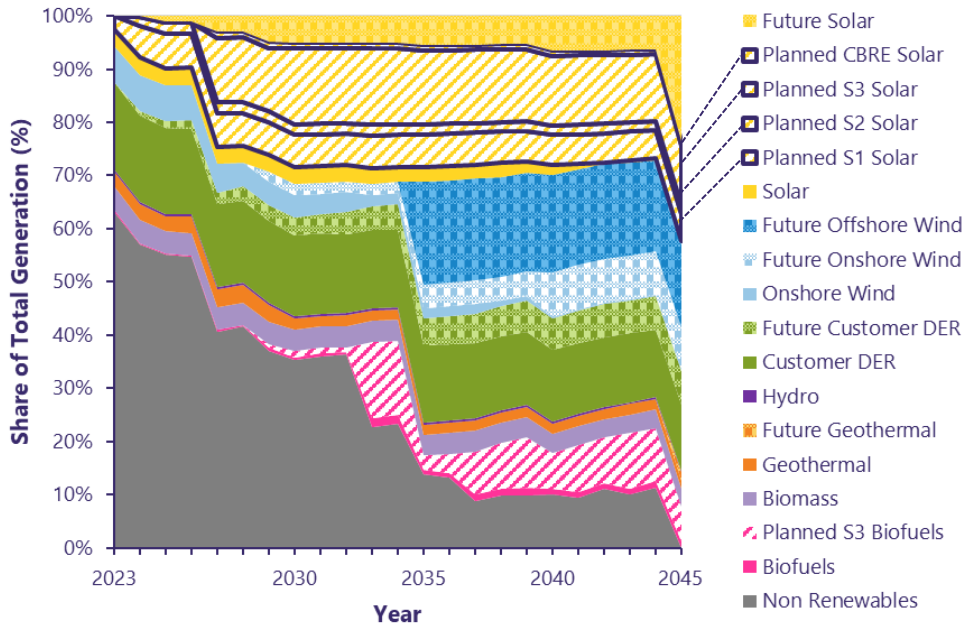

Figure 2-88. Consolidated: Preferred Plan resource generation mix (2023–2045)

Figure 2-89 shows the incremental change in capacity for the Consolidated Preferred Plan. For future solar and wind additions, the future capacity includes existing independent power producers that may be repowered after the expiration of their power purchase agreement.

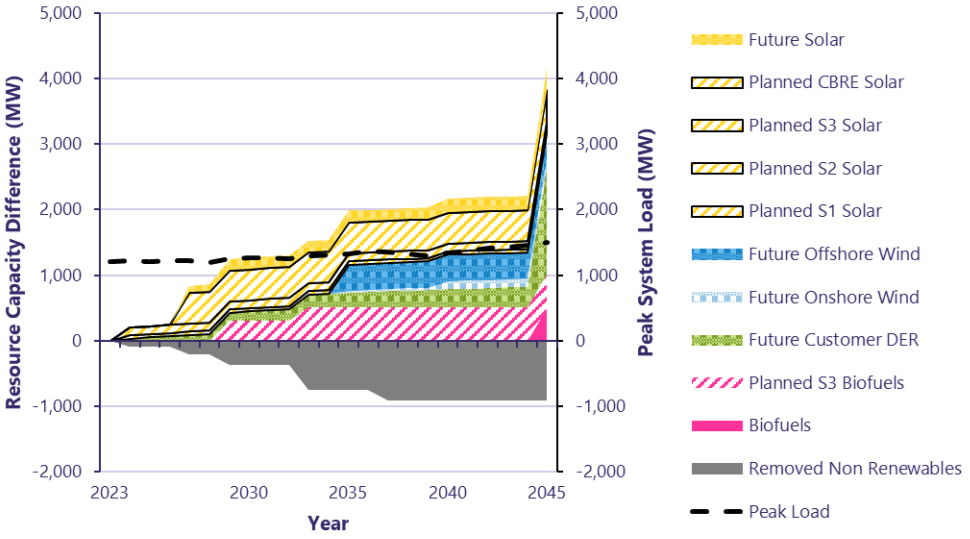

Figure 2-89. Consolidated: Preferred Plan change in installed capacity by resource type (2023–2045)

On O'ahu, Hawai'i Island and Maui, resource adequacy is expected to meet a 0.1 loss of load expectation standard by procuring resources through the Stage 3 RFP under a base load scenario. Even with the selection of the O'ahu land-constrained scenario as the Preferred Plan, which installs significantly less hybrid solar than the Alternate Plan, a 0.1 loss of load expectation can still be achieved on O'ahu with the addition of other resources including offshore wind, distributed rooftop solar, and firm renewables. Resource adequacy will need to be confirmed once the Stage 3 RFP final award groups are announced and selected projects reach

commercial operations. If the near-term load is expected to be similar to the high load forecast, more resources will be needed beyond the Stage 3 RFP targets. These resources could be procured in the Integrated Grid Plan RFP or include the delayed deactivation / reactivation of existing firm generators that were removed from service.

Figure 2-90 and Figure 2-91 illustrate the capacity and energy by technology that is included in the consolidated Preferred Plan.

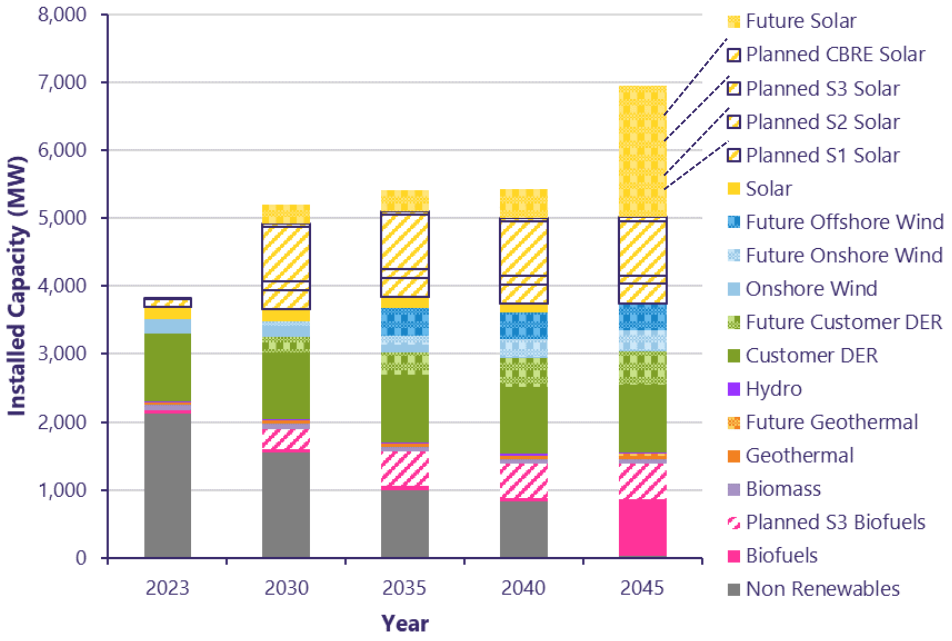

Figure 2-90. Consolidated: Preferred Plan installed capacity by resource type (2023–2045)

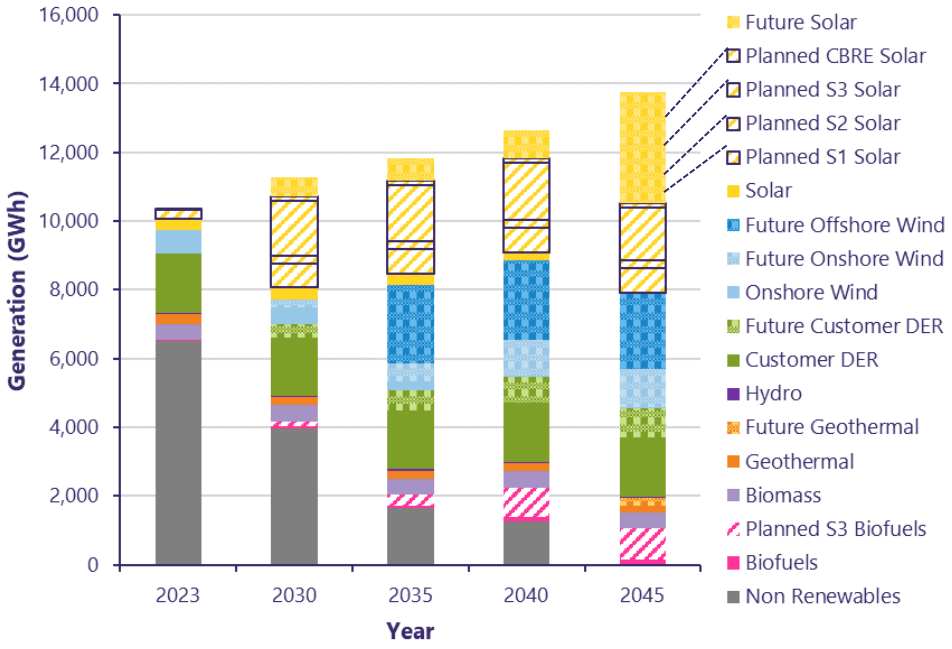

Figure 2-91. Consolidated: Preferred Plan generation by resource type (2023–2045)

Emissions for all islands' Preferred Plans are shown in Figure 2-92. By 2030, the Preferred Plans will achieve a carbon reduction of 55% compared to 2005 levels and a reduction of 76% by 2035 compared to 2005 levels. The 2030 reduction is in alignment with state policy to achieve an economy-wide reduction of 50% by 2030.

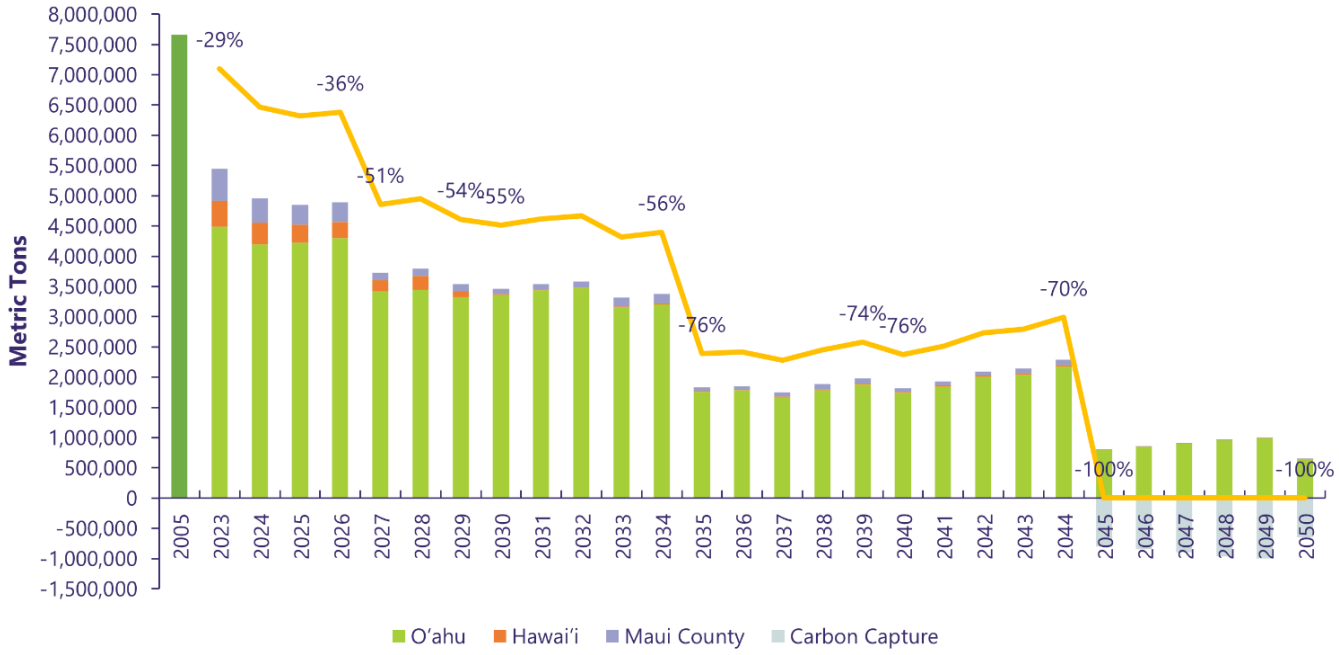

Figure 2-92. Consolidated Preferred Plans emissions and percentage reduction compared to 2005 baseline without biogenic CO_2

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3 Next Steps

The following section provides an updated schedule and timeline for the first cycle of the Integrated Grid Plan, as described in May 2023. The updated schedule allows more time to incorporate community input and address near-term equity concerns prior to the first Integrated Grid Plan procurement. It also allows more time to develop long-term equity actions for future renewable resource procurements.

3.1 Schedule

As we continue to help the Maui community recover and rebuild from the devastating August 2023 wildfires, we have extended the time to select projects from the Stage 3 RFP from October 2023 to December 2023. This necessitates an adjustment to the Integrated Grid Plan schedule to allow for the Stage 3 RFP evaluation process to be completed, with a post-Stage 3 RFP reassessment of grid needs to inform the Integrated Grid Plan RFP. Upon assessing the grid needs based on the Stage 3 final award group, we may need to adjust the Integrated Grid Plan procurement targets, which were to be based on the 2030 Preferred Plans. Examples include:

- Exceeding or not fulfilling the Stage 3 energy targets.
- Exceeding or not fulfilling Stage 3 capacity targets may add to or reduce the Integrated Grid Plan procurement target needed to maintain adequate supply to meet scheduled firm generation retirements. Generation reliability will be reassessed based on the Stage 3 final award group.
- Transmission or system security needs that must be addressed in successive procurements based upon the Stage 3 final award group, which may include relieving congestion in certain areas for future projects, location specific resource needs, or additional essential grid services.

Figure 3-1 and Figure 3-2 illustrate potential renewable energy targets for the first Integrated Grid Plan cycle to achieve the Preferred Plans through 2035. Two scenarios are shown: 50% and 100% fulfillment of the Stage 3 renewable energy target by the Stage 3 final award group. The 2027 energy (GWhs) targets are based on the Stage 3 RFPs. The energy target shown in years 2028 to 2030 is based on the resources in 2030 of the Preferred Plans distributed evenly over the three years. The energy targets from 2031 to 2035 are based on the 2035 resources evenly distributed over the five years. For O'ahu, this is primarily the offshore wind resource in the Preferred Plan. In this instance, a single project like offshore wind could satisfy the energy needs for 2031 to 2035 or multiple projects over the five years.

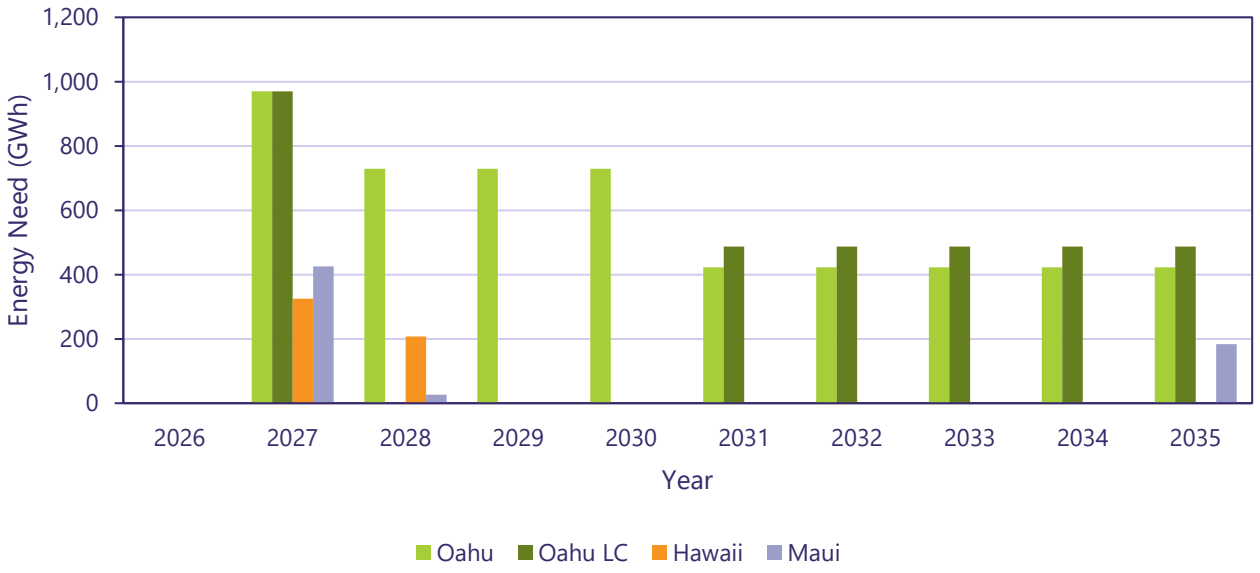

Figure 3-1. In-service renewable energy by year. 100% of O'ahu Stage 3 target met.

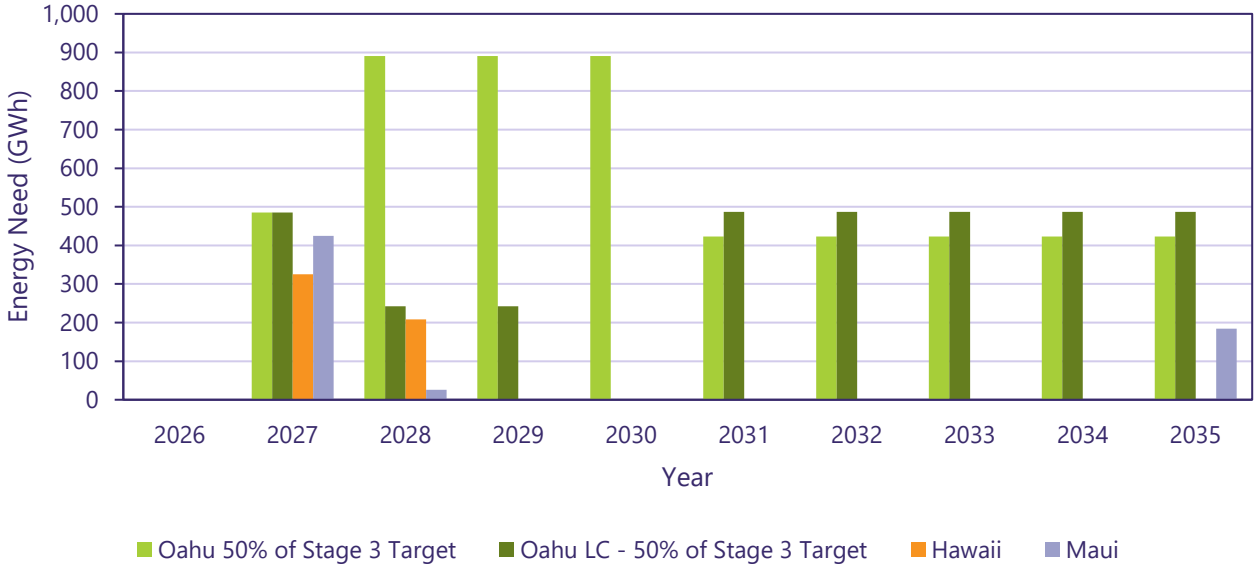

Figure 3-2. In-service renewable energy by year. 50% of O'ahu Stage 3 target met.

Both figures demonstrate that continuous procurements for renewable energy will be needed as part of our Preferred Plans, particularly on O'ahu.

- The O'ahu Preferred Plan, which modeled the land-constrained scenario, represents a more consistent, less "lumpy" run of procurements over the near term.
- The O'ahu Alternate Plan, which modeled the base scenario, would require more significant transmission infrastructure and rapid development of transmission plans in concert with communities, state and county agencies and landowners, among others.

However, in all scenarios, these 10 to 12 years send a strong signal to market participants that procurements are expected to continue at a brisk pace. This does not include procurements to address other needs such as transmission or system security needs, resource adequacy and capacity needs, or resilience needs, which may be in addition to energy target needs.

The example procurement schedules in Figure 3-1 and Figure 3-2 are focused primarily on O'ahu, as Hawai'i Island and Maui are expected to achieve high levels of RPS that exceed 90% by 2030.

Figure 3-3 is a revised schedule with approximate dates for forthcoming procurements to meet the 2030-2035 Preferred Plan goals. This includes a "rolling" procurement that could potentially include two procurement cycles to get projects in-service by 2030, as well as a long-term procurement that would aim to get projects in-service by 2035.

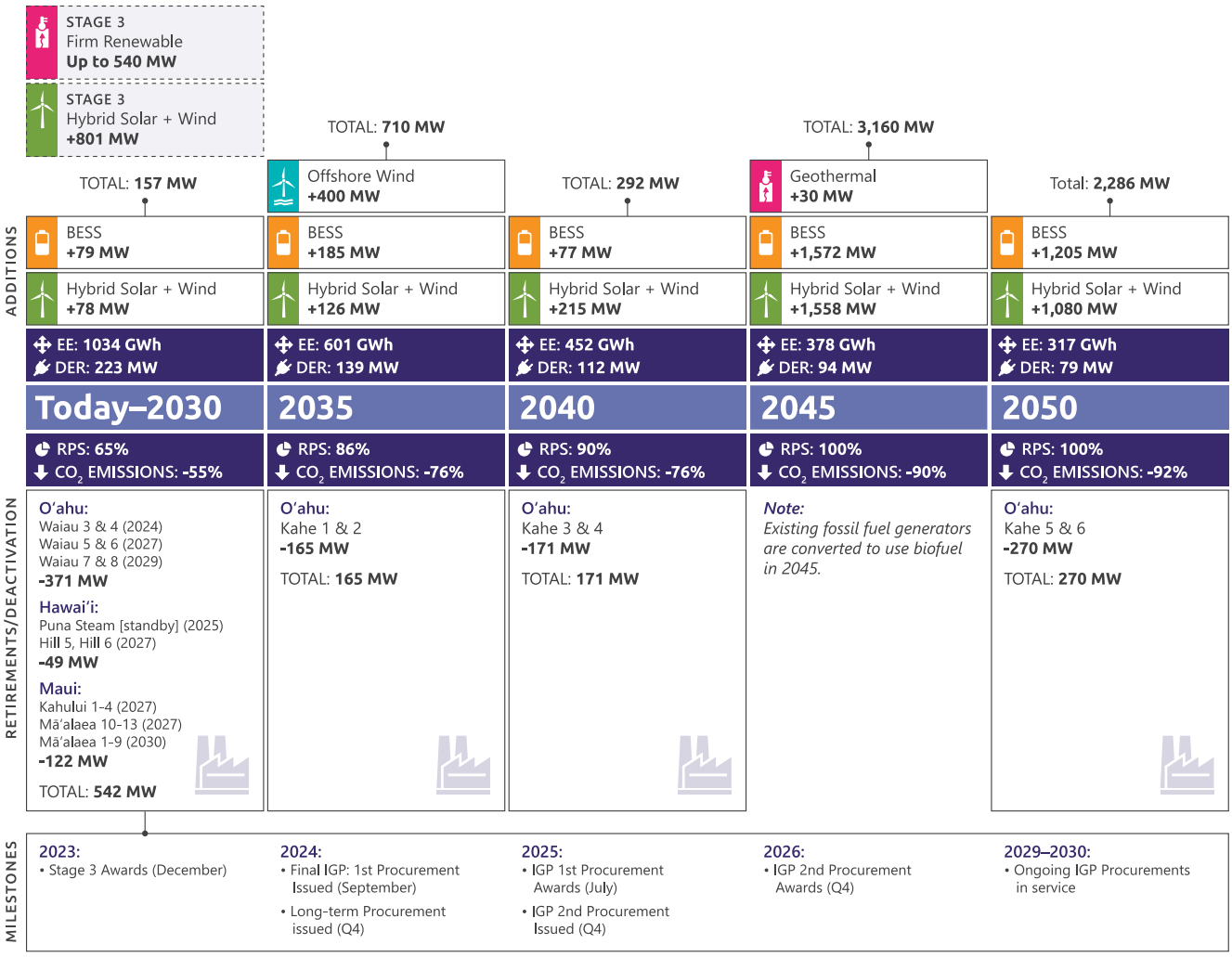

Figure 3-3. Proposed timeline of adding renewable resources, retiring or deactivating fossil fuel–based generation and reducing carbon emissions

3.2 Next Cycle

Prior to commencing the next Integrated Grid Plan cycle, it will be important to allow for the necessary time to execute and implement the Integrated Grid Plan Action Plan. This includes at least two procurement cycles and a long-term procurement to provide additional clarity on the necessary resources to achieve the 2030 and 2035 Preferred Plans.

As customer programs and procurements develop over the next several years, the Integrated Grid Plan framework allows us to continually update our plans and roadmap with actual and planned resources. We also can leverage the range of scenarios and forecasts in the Integrated Grid Plan to adjust to changing conditions (i.e., the low and high load scenarios). Interim updates may also include generation reliability assessments after procurement selection of projects to ensure that sufficient resources are being added to the system to facilitate planned fossil fuel retirements.

There are several key priorities that must addressed prior to the development of the next Integrated Grid Plan cycle:

- Clarity on renewable potential based on community and land use, including major expansion of the transmission system to facilitate renewable energy zones
- Completion of the resource adequacy study and establishment of a reliability standard
- Performance assessment of the hybrid solar and standalone battery energy storage system facilities, including grid forming inverters
- Focus on and prioritization of public safety and implementation of resilience measures to keep our communities safe
- Review of the multi-year rate period

With several large proceedings that will require the attention of limited stakeholder resources, including review of the multi-year rate period (i.e., year 4 review), we propose the next planning cycle should occur after key priorities and upcoming dockets are resolved. The Integrated Grid Plans and Preferred Plans should serve as a starting point for resolution of key initiatives and proceedings. We must also allow time for the first cycle to be fully implemented, so that lessons learned and major updates can be incorporated into the next planning cycle.