

Microgrid Law & Policy of Hawaii

Strategies for Resilience and Cost Control



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National
University

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Hawaii Natural Energy Institute

Hawaii Natural Energy Institute (HNEI)

School of Ocean and Earth Science and Technology University of Hawaii at Manoa (UHM)

- Founded as organized research unit in 1974, established in statute in 2007 – serves as the State’s lead on energy resource and technology development seeking solutions to renewable generation, transportation fuels, grid integration, and energy policy
- 4 major funding sources; UHM, Barrel Tax, Extramural, Applied Research Laboratory– alternative energy via HNEI recognized as core competency for the UH Advanced Research Laboratory
- Diverse staff including engineers, scientists, lawyers; students and postdoctoral fellows, combining research excellence & deep experience:
 - Our policy team features a former PUC Commissioner & State Energy Administrator – GridSTART features >120 years cumulative utility experience
 - Two of the three current PUC Commissioners were hired directly from HNEI



Microgrid Progress in the U.S.

Primary Use Cases

- **Resiliency and energy security** – U.S. Department of Defense installations
- **Public purpose** – resiliency and cost reduction on governmental locations
- **Innovation** - research, design and demonstrate (utilities and research institutions)
- **Wireless Infrastructure** – building non-wire alternatives
- **Distributed Infrastructure** - behind the meter energy management



Transitions to Island Energy Systems Occur at 3 Levels

- Landscape
- Regime
- Niche



Explaining Hawaii's Energy Transition as...

-A multilevel and purposive policy-driven sustainability and self-sufficiency socio-technical intervention

consisting of:

- Renewable resources
- Smart and advanced, modern grids
- Energy storage systems
- Effective governance and oversight

-Meeting its long-term objectives through niche-level innovations and advances



Multilevel Perspective (MLP) – the Niche

The niche level refers to a smaller but important locus of innovation that can bring transitions at the regime and landscape level.

Niches at the micro level stimulate experimentation including the co-evolution of technology, user practice, and regulatory structure which lead to regime level shifts for sustainable development.

In other words, novel experiments and innovations at the niche level directly result in enhancing sustainability at the regime and landscape levels.



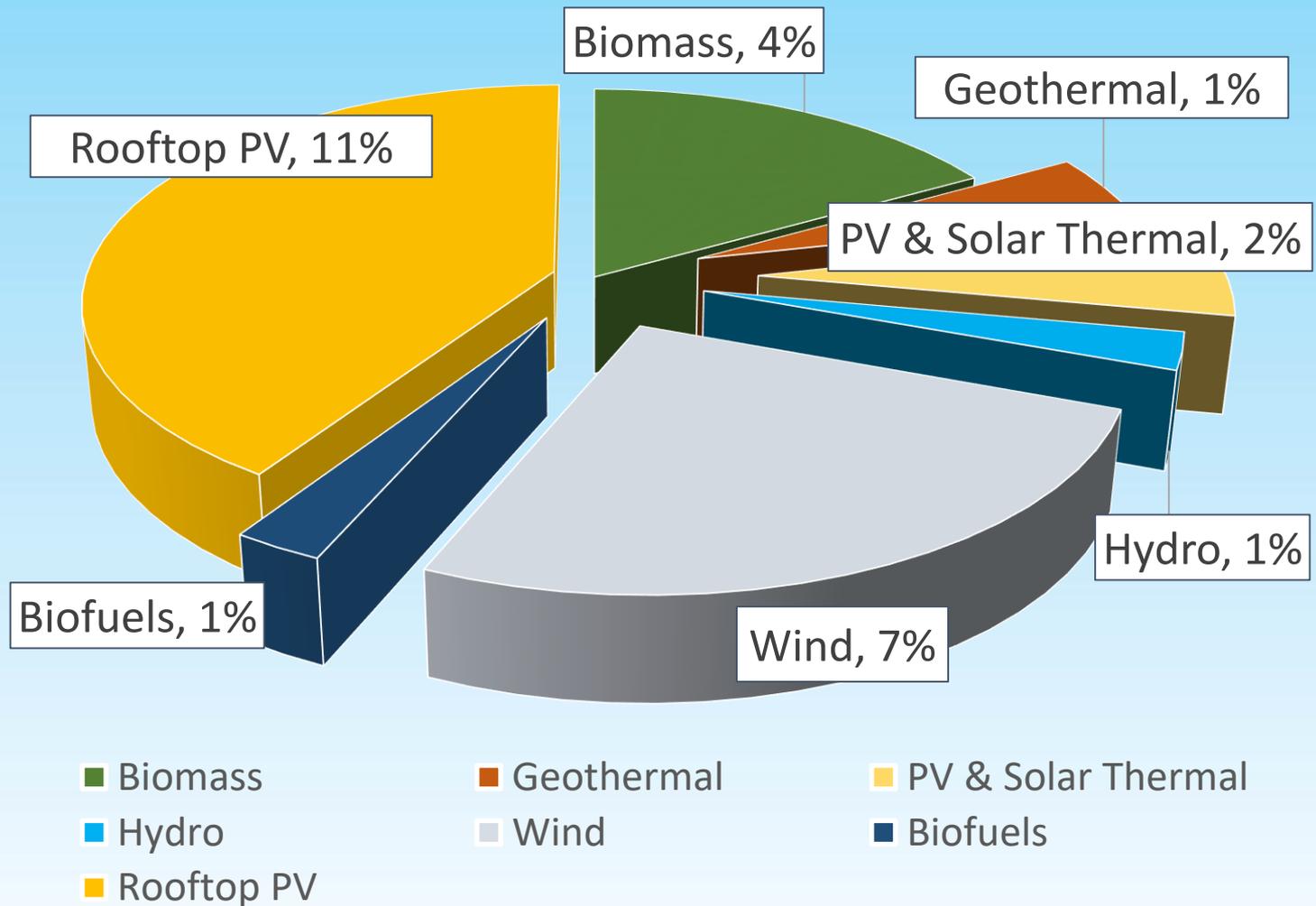
Hawaiian Electric Companies – 2018 RPS Status Report

27% Total

22% HECO
(Oahu –
Honolulu)

44% HELCO
(Hawaii
Island)

38% MECO
(Maui,
Molokai,
Lanai)



Microgrid Progress in Hawaii

Primary Use Cases – per Hawaiian Electric Companies

- Hawaii's largest utility considers resiliency the principal purpose of a microgrid relative to regulatory oversight
- It asks a number of associated questions meant to drive discussion and subsequent formulation of use cases and requirements include the following:
 - Will the microgrid utilize above-the-meter, utility-scale assets for islanded support, below-the-meter customer-scale assets, or a combination (drives discussion on costs, ownership, architecture, coordination, operations, number of customers covered, etc.)?
 - What is the role of the aggregator in the formulation of a microgrid (drives discussion of control and life-cycle responsibilities of parties using utility-owned assets, customer-owned/aggregated assets, developer-owned/aggregated assets)?



Microgrid Progress in Hawaii

Primary Use Cases – from Exhibit 8: Docket 2018-0163

- Questions continued:
 - Will the microgrid provide services to a fraction of its grid-connected load, or is the islanded microgrid expected to serve a broader electric power system during resiliency operations (drives discussions on incentives, architecture, operations)?
 - How will the microgrid interact with local utility protection, relay, and control (PRC) applications (drives discussion on whether natural boundaries will be set up with existing protection equipment or if new sectionalizing and PRC subsystems must be established)?
 - If the primary grid goes down, will customers experience an outage before the microgrid restores power or will the forming of a microgrid be transparent to those within the microgrid service territory (drives discussion about customer notification, modification of customer behaviors while in the islanded microgrid state, ride through vs. break-before-make or make-before-break configuration, and total number of customers served)?



Our Perspective - Hawaii as a Test Bed

- South Korea and Hawaii - 2015 MOU between Hawaii and Korea Institute of Energy Technology Evaluation and Planning (KETEP) to cooperate in the development of green energy technology
- HNEI and SNU assembled a team that received KETEP International Energy Collaborative R&D Program grant to conduct a feasibility study on microgrid platforms at 3 potential Hawaii sites.
- HNEI formed a six-party alliance to apply for the 2nd step – via KETEP Mission Innovation grant funding
- The alliance won a KETEP grant to build advanced microgrid in Hawaii in a project that concludes in June of 2021.

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Mission Innovation - Hawaii-Korea Microgrid

Deployment and Operation of “Smart” Microgrid Featuring Distributed Resources with Resilience in Off-grid Events

- Apply big data /reinforcement learning based prediction and optimization algorithms
- Development of system scalability through local EMS interworking
- Design-deploy power trading model/service
- Coordinated control for DG, diesel back-up generator, PV+ESS to maximize off-grid operation time
- Real-time Simulator (RTDS) based system simulation and algorithm verification
- Includes microgrid optimal design methodology

- Microgrid system design & on-site engineering for PV, ESS, Control system
- Install & operate AI-based cloud/local EMS
- Analysis of empirical results on economical value and system stability



AI-Based Cloud EMS

Off-Grid Operation



Microgrid System Operation

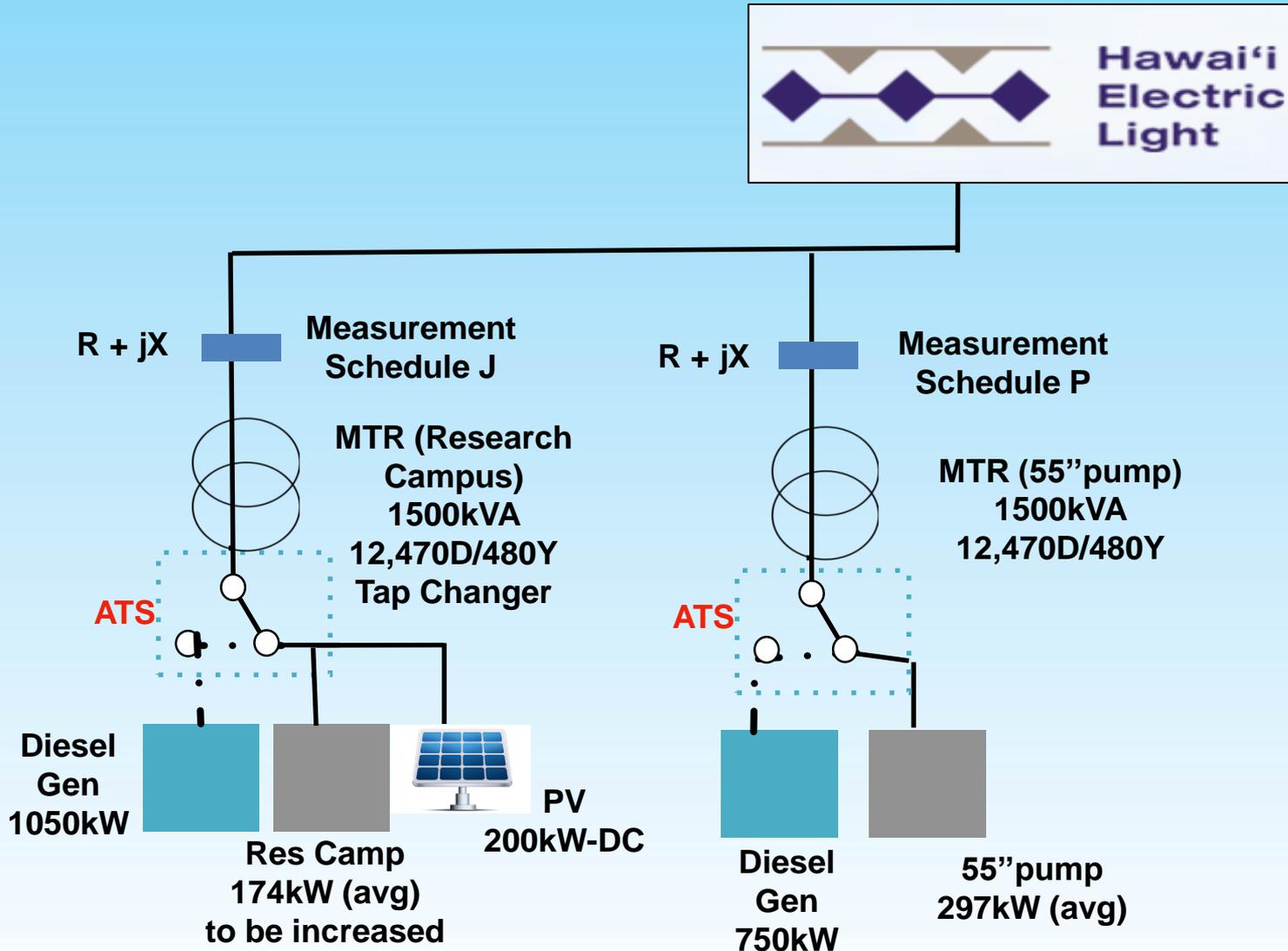


Business Model

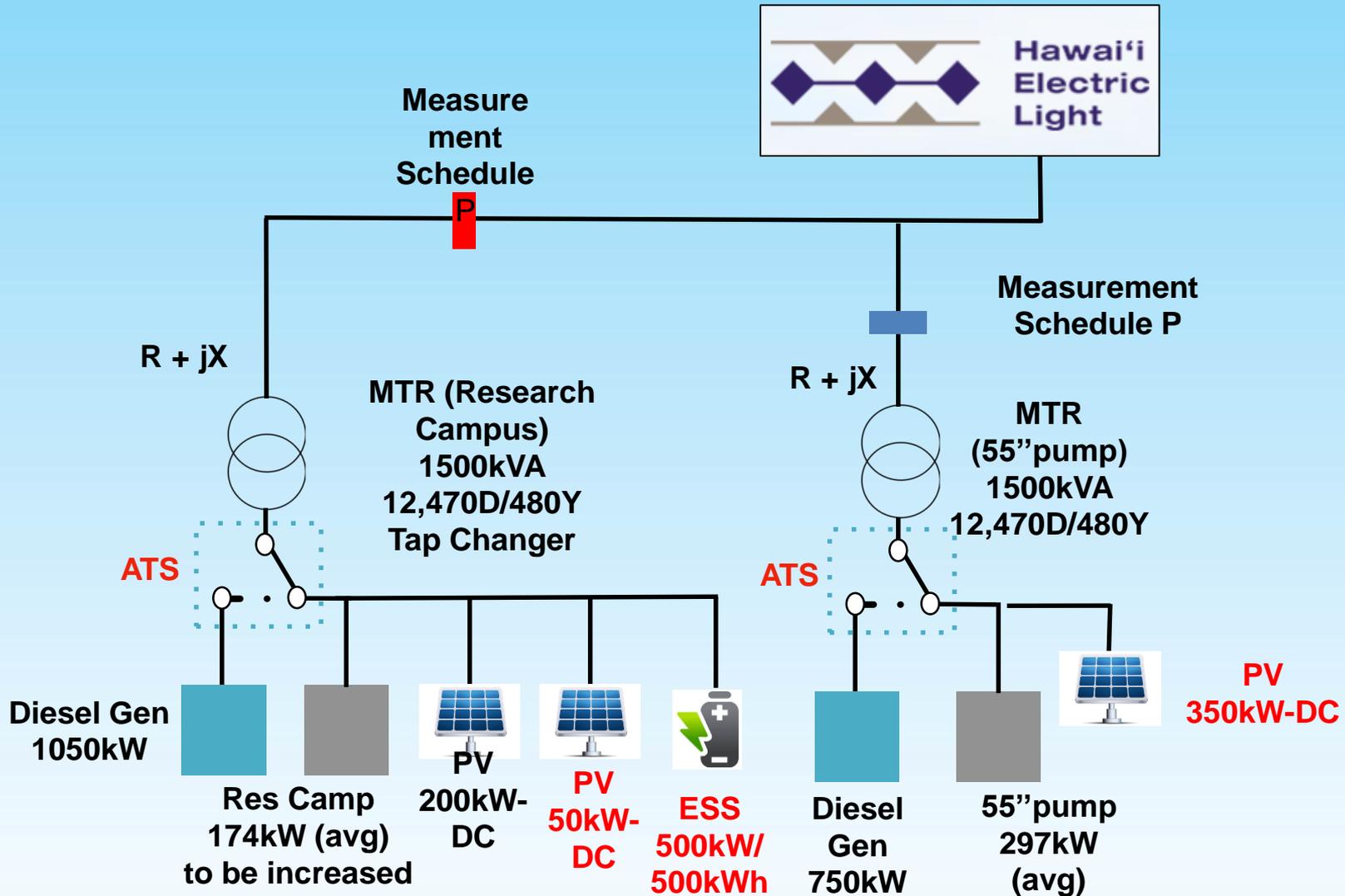
- Integration of law and regulation in Hawaii
- Guidelines for microgrid business models
- Creation of a replicable, localized new energy service model

Supporting Hawaii's drive for 100% renewable energy through deployment of locally optimized microgrid operation technology

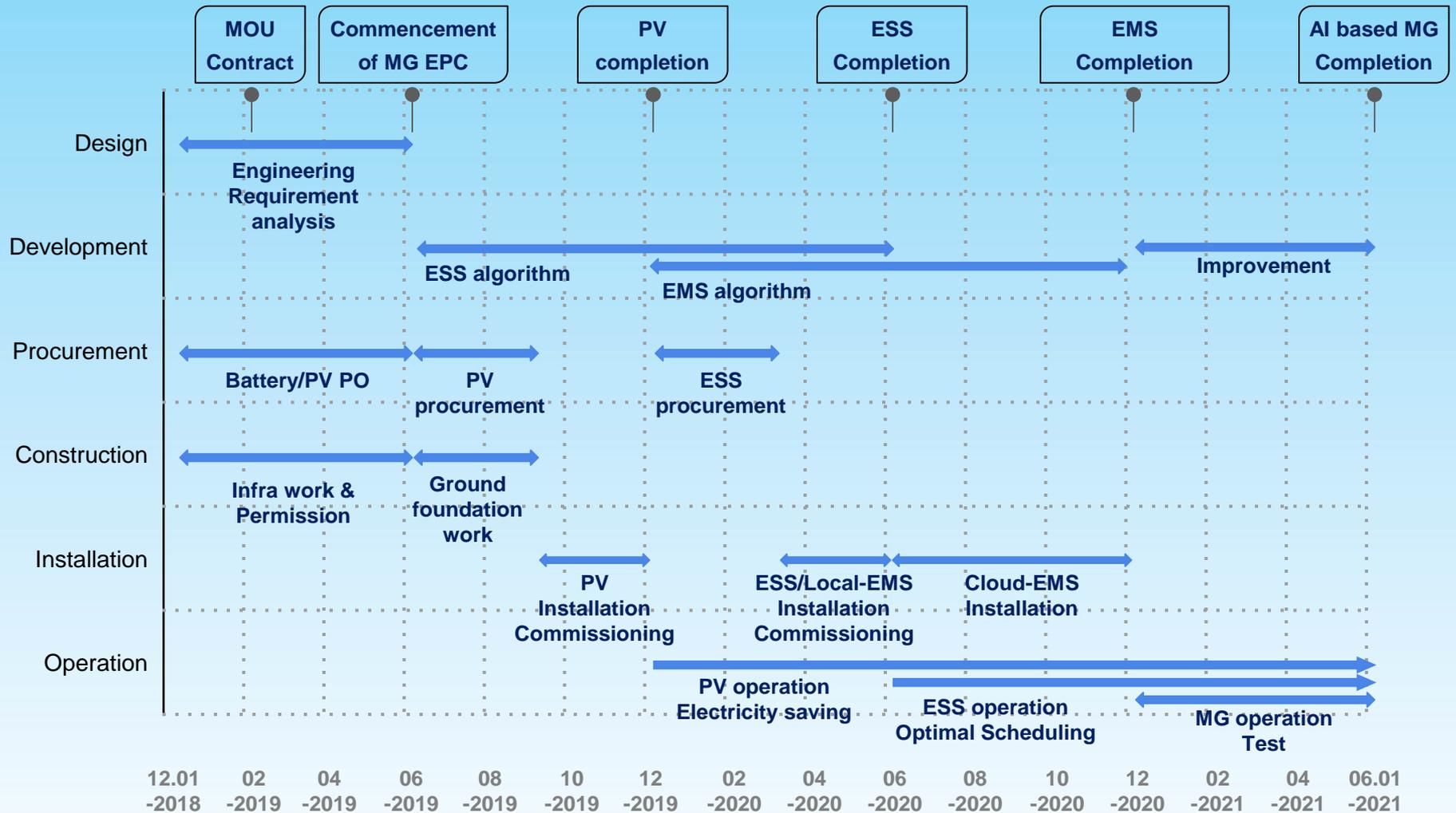
Current NELHA System Configuration



Proposed System Configuration



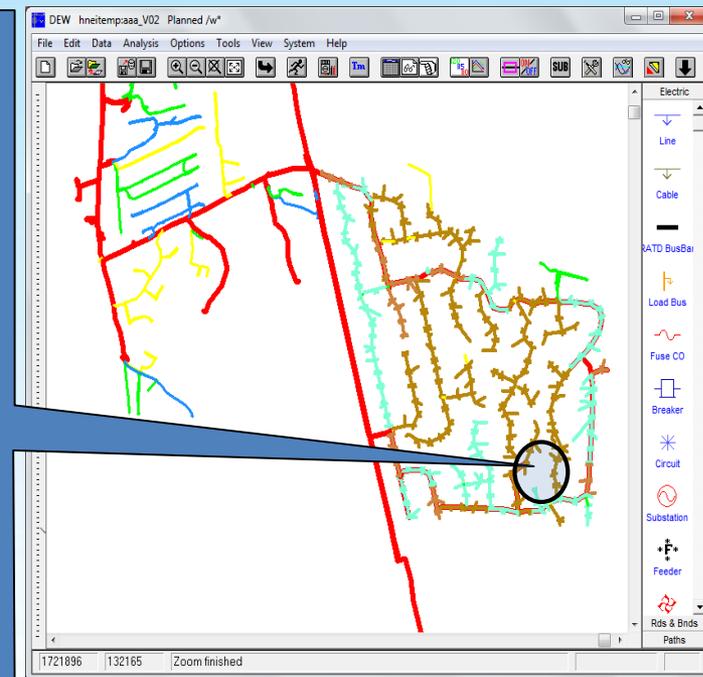
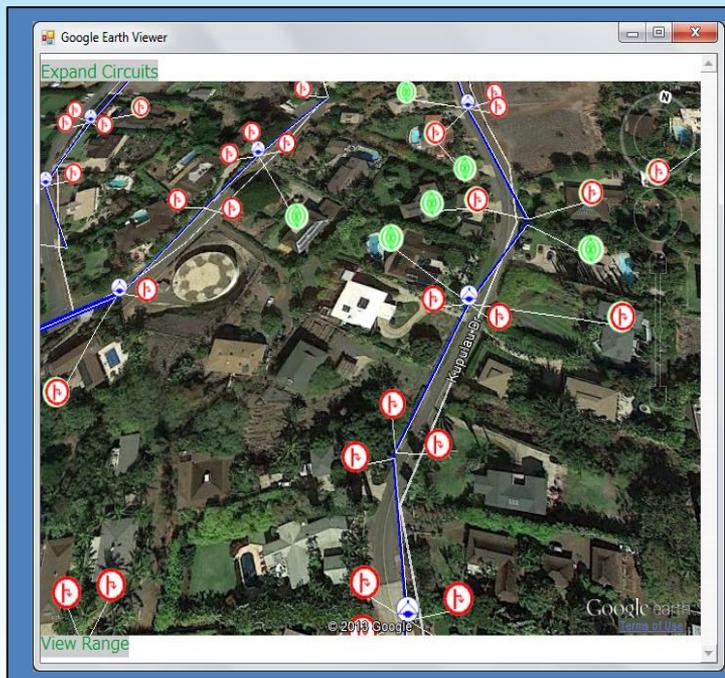
Ambitious Timeline by Hawaii Standards



Next Steps – Informed Energy Policy

Analysis to Inform Policy & Utility Operations

- Analyses cited in Utility Commission decisions and numerous recommendations have been adopted
- Reduce costs by not over-building assets
- More renewable integration of high-penetration renewable grids
- Microgrids are likely to play a key role moving forward



Thank you!



HNEI

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