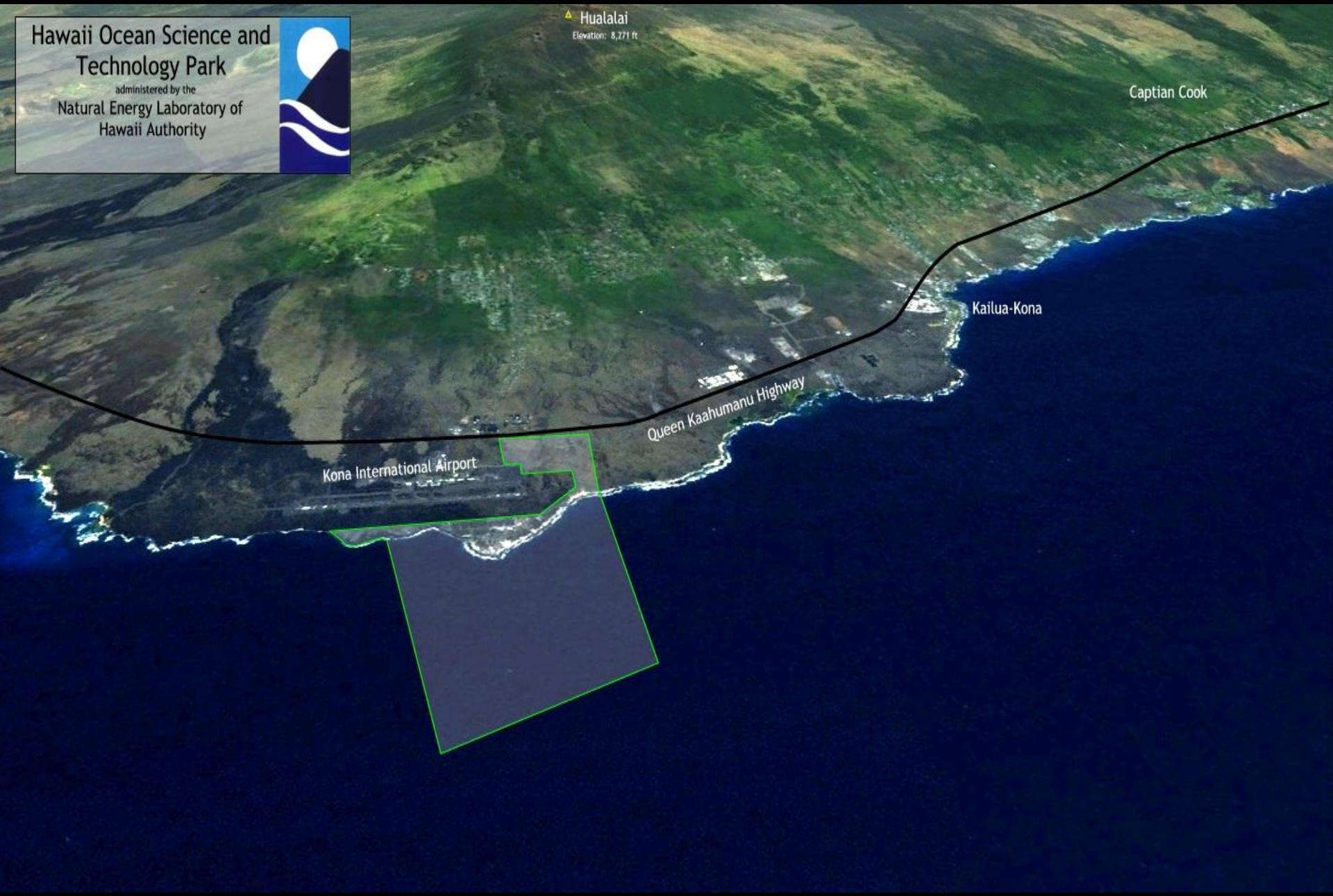
Natural Energy Laboratory of Hawaii Authority

NELHA ESS Conference

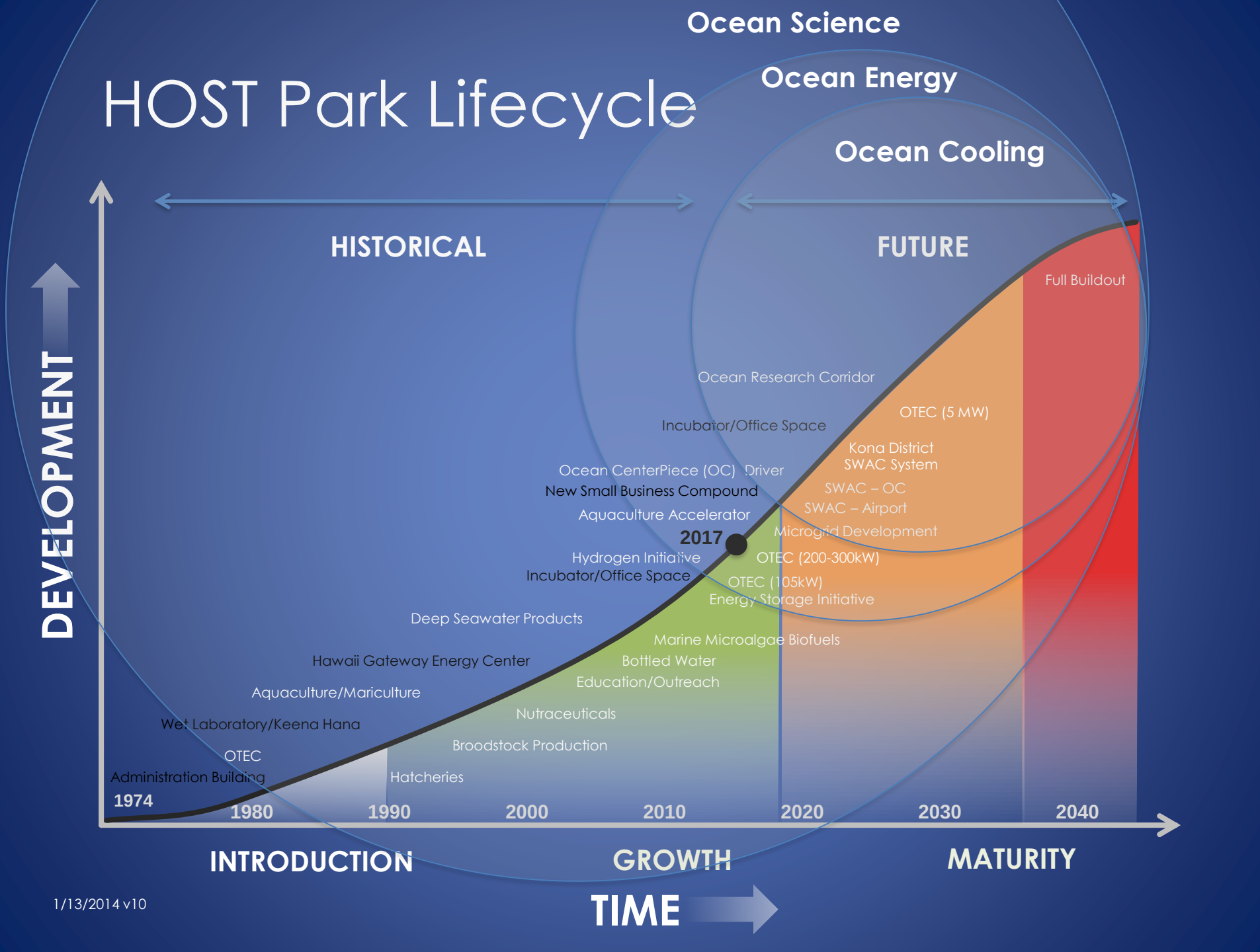
Gregory P. Barbour
NELHA Executive Director

December 5, 2018


Hawaii Ocean Science and Technology Park
administered by the
Natural Energy Laboratory of Hawaii Authority
Hualalai
Elevation: 8,271 ft
Captian Cook
Kailua-Kona
Queen Kaahumanu Highway
Kona International Airport

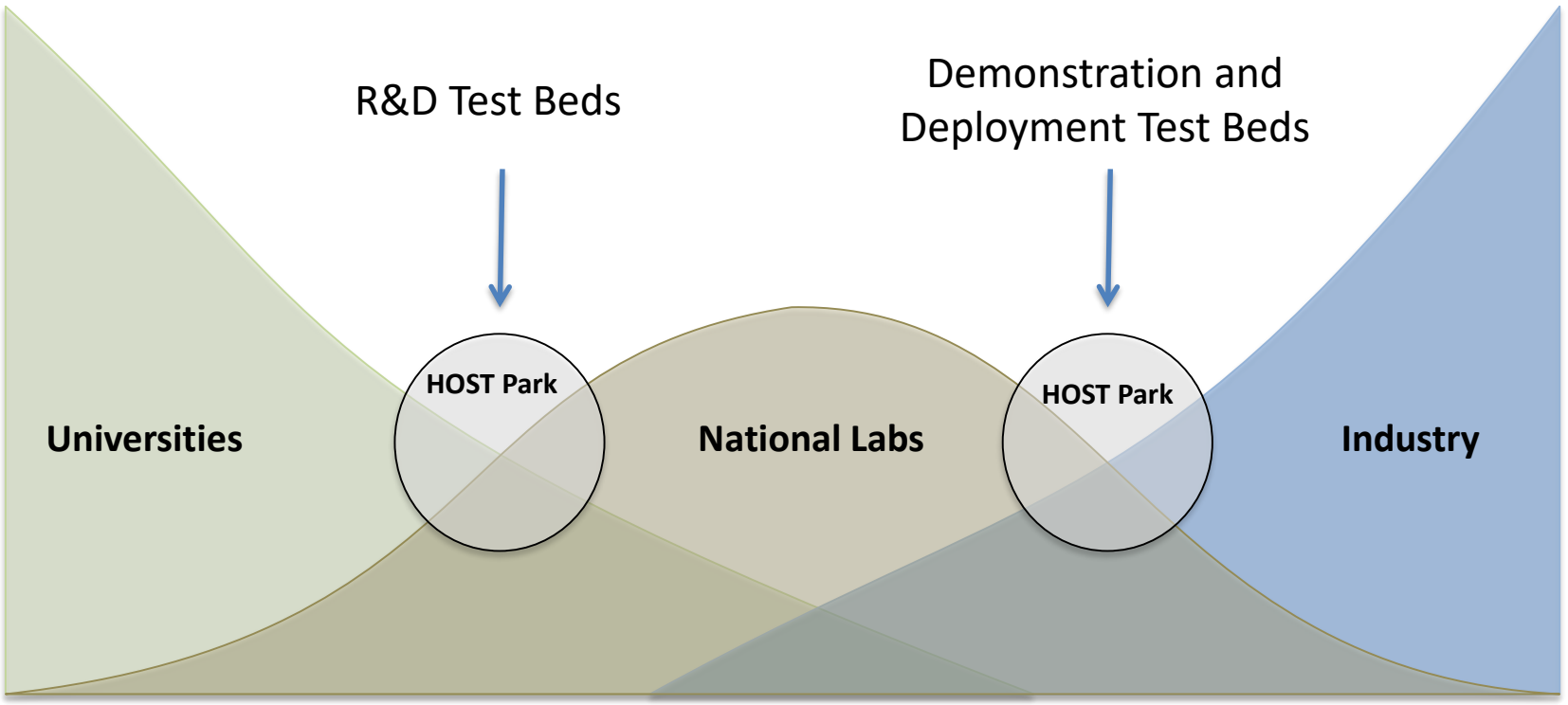

Booster and Interim
55"
55"
Beach Park
28"
24"
SOUTH SEAWATER SYSTEM
Kau
24"
Research Campus
NORTH SEAWATER SYSTEM
28"
40"
18"

HOST Park Lifecycle



1/13/2014 v10

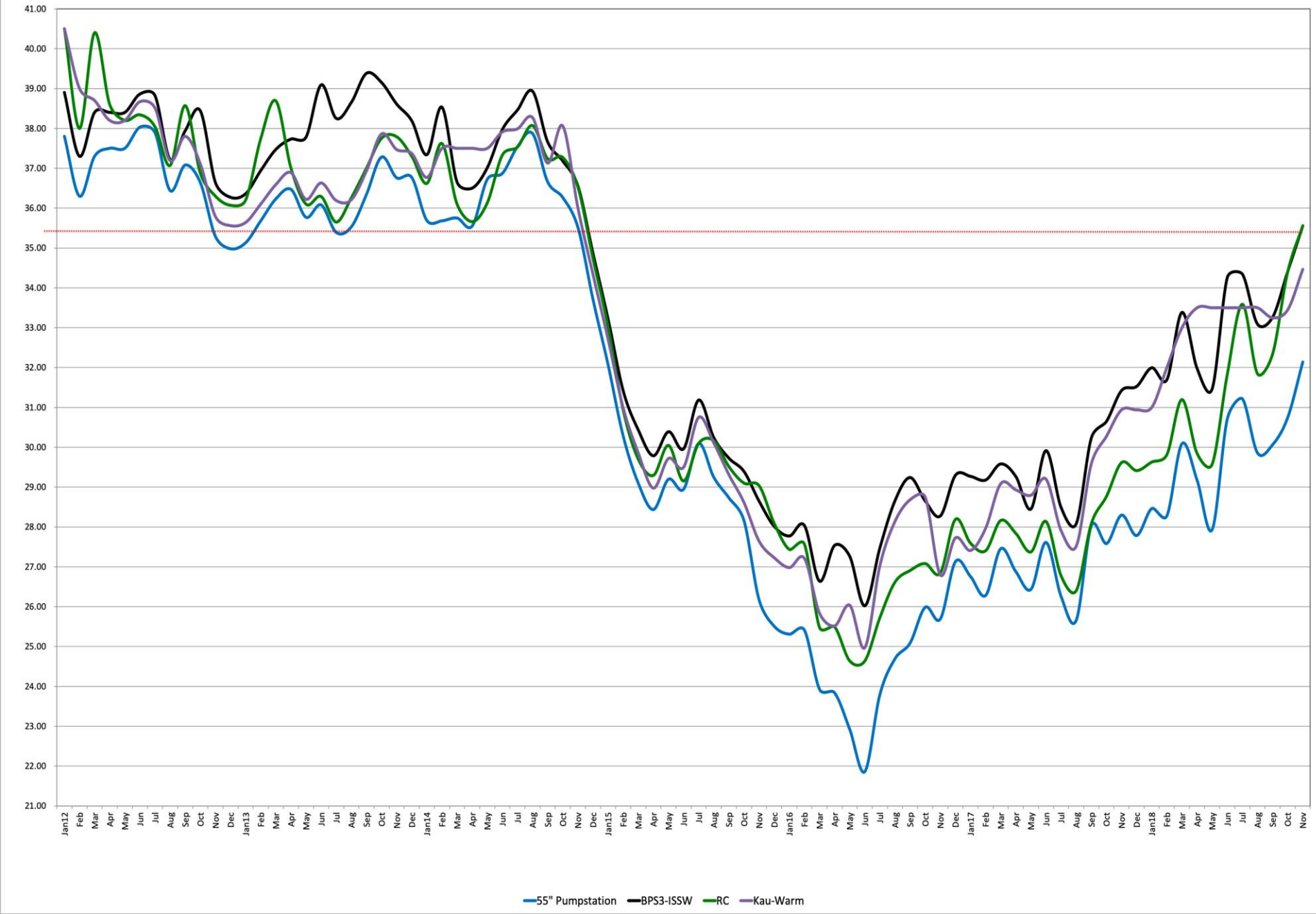
Bridging the "Valleys of Death"



Adapted from Allen

Research Campus/Kau-Warm/BPS3-ISSW/55" Pumpstations

Cents per KWH



NELHA
Natural Energy Laboratory of Hawaii Authority

CURRENT ENERGY INITIATIVES

Clean Tech and Renewable Energy Strategy

- **OTEC is primary focus.**
- **In addition, focus as an outdoor demonstration site for, national labs, DOD, and private sector. Not Basic Research.**
- **Add clean energy, storage devices, real world grid connected simulations, renewable energy integration, smart/micro grids.**
- **Asia/Pacific location.**
- **Biofuel/CSP/SWAC/OTEC/OCAES projects.**
- **Demonstrate "integrated" clean energy systems (Airport/NELHA/County/HELCO).**

Pursuing near-term projects is important to making progress, and also informs policy needs

Current Projects

Features

1. **Near term projects should fit within current constraints.**
2. **Ability to streamline project siting** is a key differentiator for NELHA.
3. Requires **capital** investment.
4. Seek **tech expertise** to vet and execute projects (e.g, through partnerships, research comm.)
5. Provides opportunity to directly engage **labs and universities (HNEI)**.
6. Requires engaging with **partners** (e.g., HELCO, Airport, NGO's).

Focus Areas

1. **Energy storage** projects.
2. **Ocean & solar** electric generation.
3. **Solar thermal** desalination.
4. Regional **seawater air conditioning**.
5. **Energy efficiency** for seawater pumping system.
6. **Microgrid** projects at a limited scale. Full microgrid probably unrealistic at this time. Research microgrid is much more attractive.

Need to continue to identify policy issues and advocate changes to enable future projects

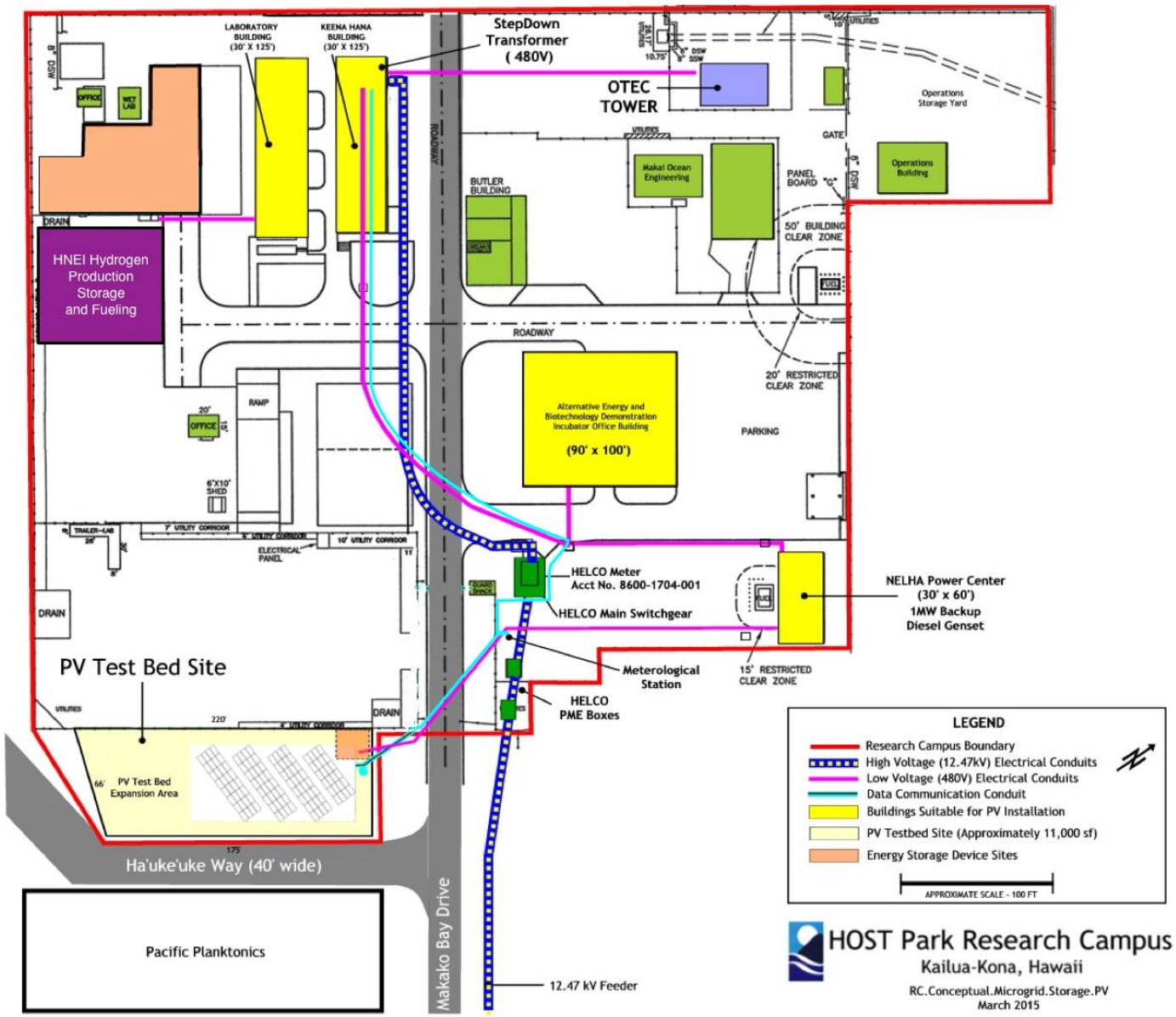
Policy Challenges

Features	Focus Areas
1. Requires political capital and time. 2. Enables NELHA to host a greater range of technologies. 3. Requires engaging with HELCO. 4. Seek technical expertise to explore details of options, e.g, through partnerships, advisory group, or board subcommittee.	1. Address challenge of energy distribution within park • Enable wheeling across TMKs • Consolidate TMKs • Apply for a waiver 2. Address procurement constraints. 3. Address ocean energy master permitting. 4. Expand Enterprise Zone eligibility beyond just wind.

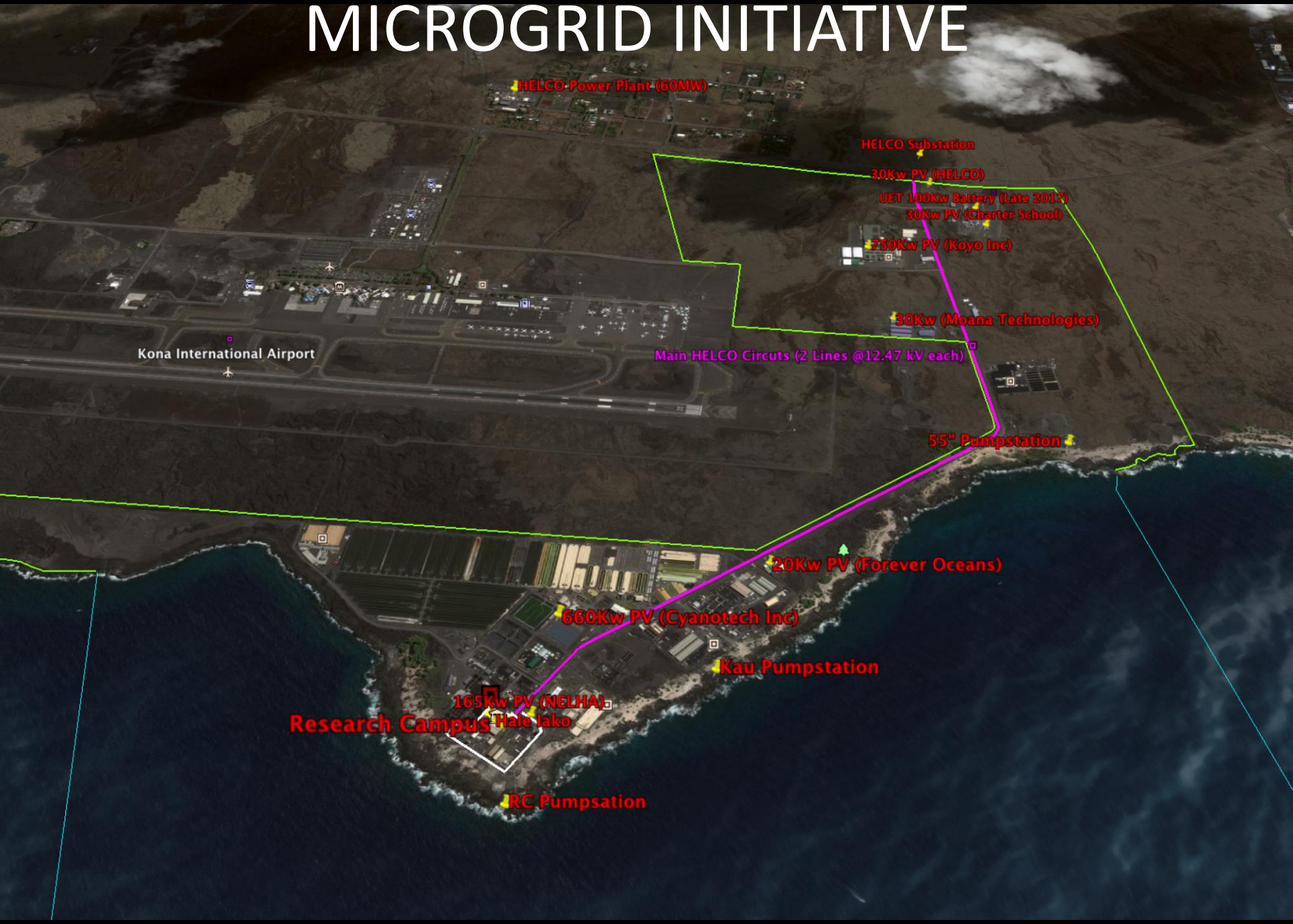
Gateway Site

- Site for the grid connected 100kW UET battery. Generation 3 - Vanadium Flow. PNNL.
- Funded by US DOE, UET, HELCO and Ulupono.
- CSP site (4 acres) is no longer operational and owned by NELHA
- Received $2M grant from US DOE for a solar desalination project
- In discussions with UW to lease Gateway Center for a Physicians' Assistant program

CONCEPTUAL PLAN AND BASE MAP FOR MICROGRID, STORAGE, AND SOLAR TEST BED



MICROGRID INITIATIVE



Hydrogen, Production, Storage and Fueling Station
(Commissioning Phase)


Fuel Company

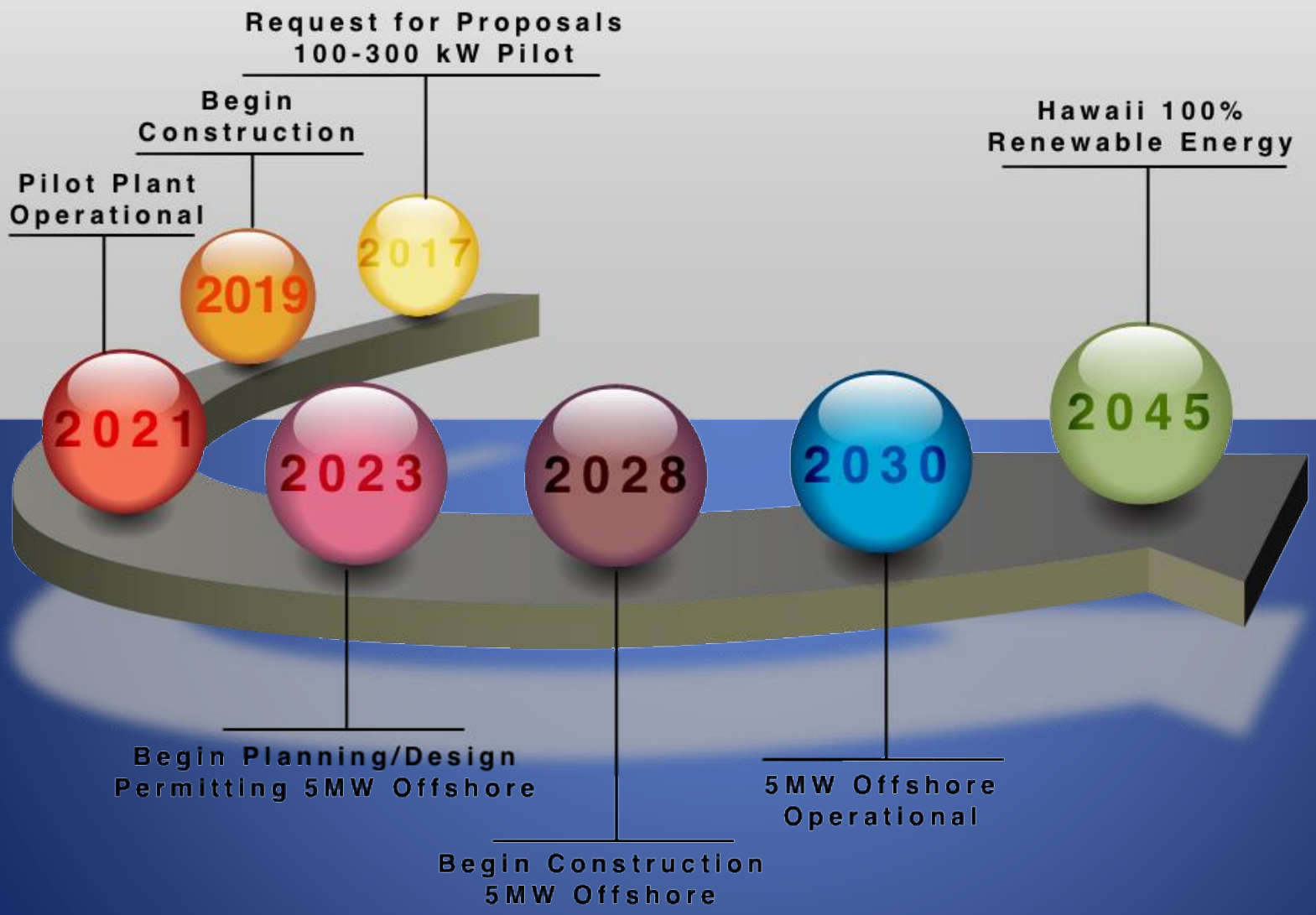
NELHA
Natural Energy Laboratory of Hawaii Authority

Ocean Thermal Energy Conversion

- Commercial interest in ocean energy is growing at a global level.
- Wave and tidal as well as OTEC.
- Many obstacles stand in way of its deployment and full potential.
- OTEC still in the early demonstration phase.
- Single units and short duration testing.
- No technology convergence.
- High investment costs and low oil and gas prices.
- Desperate need for a game-changing technological breakthrough.


MAKAI
OCEAN ENGINEERING
OCEAN ENERGY RESEARCH CENTER
DANGER
HARD HAT AREA
NOTICE
RESTRICTED AREA
AUTHORIZED PERSONNEL ONLY

ROADMAP FOR COMERCIALIZATION OF OCEAN THERMAL ENERGY CONVERSION (OTEC)



NELHA
June 2017

REGIONAL SWAC FEASIBILITY

Questions and Answers