

# Making Use of Big Data

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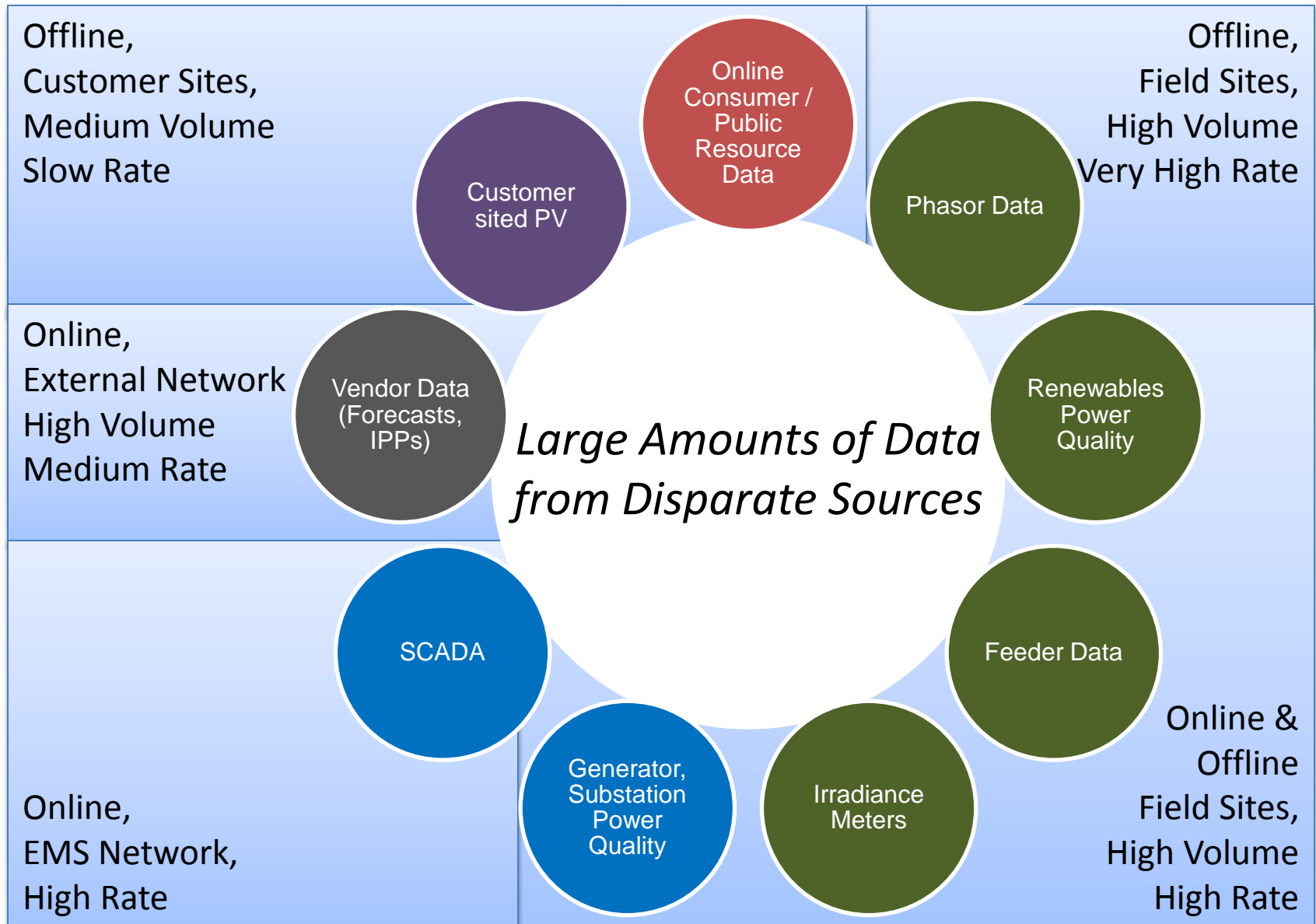
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- Integrate all available renewable data sources into a common platform
- Securely share data between visualization, analysis, modeling, and forecasting applications
  - Utility and vendor systems
  - Utility and the public
- Enable and accelerate renewable decision making for both operations and planning time scales

# Diverse Data Sources



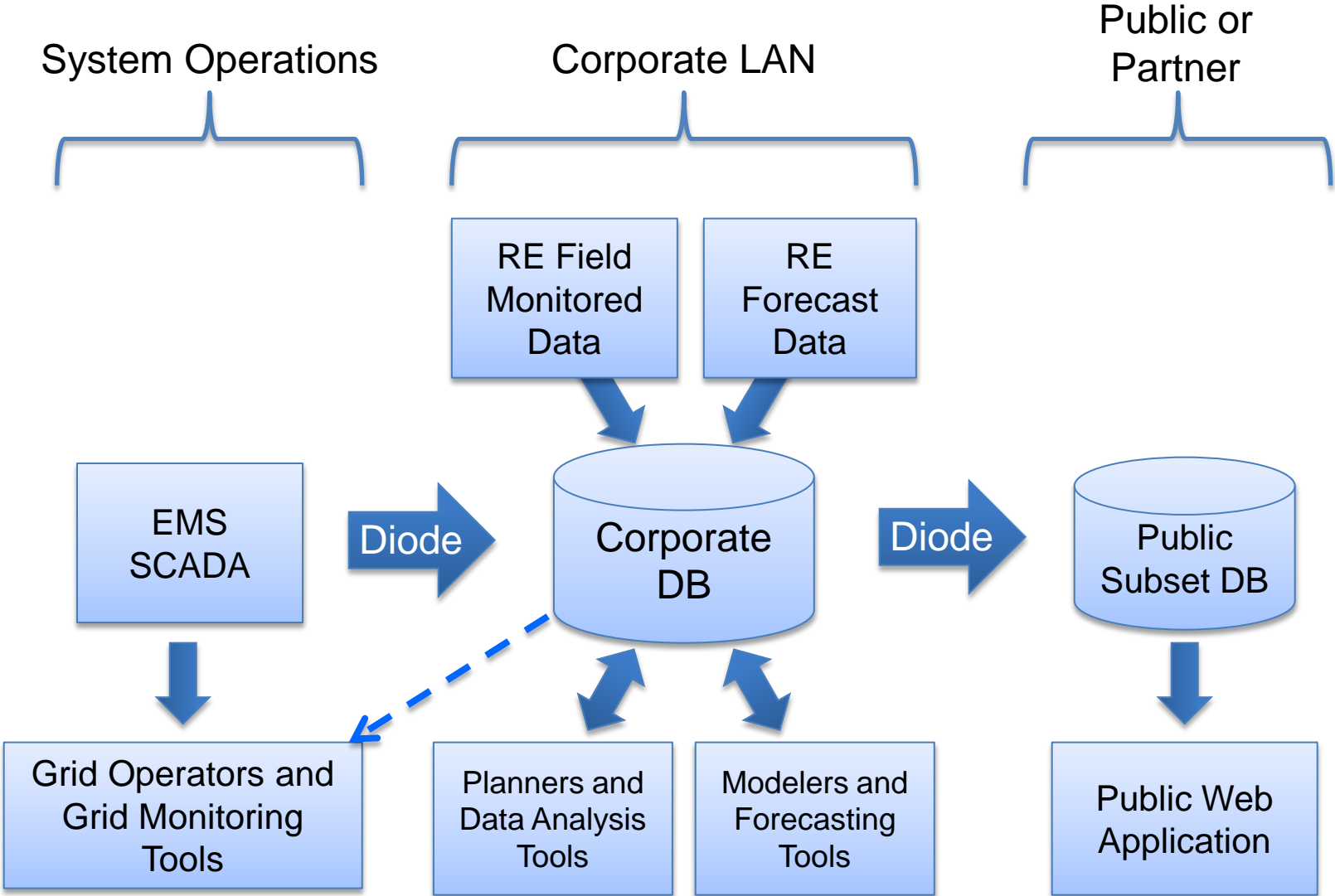
- Planners, grid operators, utility customers
- Variety of:
  - Query needs (real-time streaming, historical analysis)
  - Computer networks
  - Background knowledge
  - Application goals

Use Cases	Software Systems	Network Location
Monitoring and Real-time Decision Support	Siemens or Alstom EMS	EMS
	T-REX Perspective	
Renewable Forecast Building	AWS Forecasting	Vendor
Distribution Model Building and Validation	Vendor Modeling Software	Vendor
Renewable Project Siting and Monitoring	T-REX Web	Internet
Renewable Planning Transmission Planning Generation Planning Distribution Planning	T-REX Perspective T-REX Web T-REX Toolbox for MATLAB Microsoft Excel	Business LAN
Distribution Energy Management	Hitachi DMS	Vendor

- Take advantage of ordered data
  - Avoid relational database row and index overhead
- Support more than one time indexed data stream
  - Integrate real-time streaming data with offline or historical data
  - Mix data sources with differing data rates and sensor counts
  - Avoid backfill processes (historians) or index updates (relational)
- Lossless compression
  - Reduce disk space without affecting future analyses
- Network bridging options appropriate to security requirements
  - Hardware enforced one-way
  - Controlled bidirectional (firewall or lightweight guard)
- Desktop and web based data visualization and analysis
- API's for extensibility
  - General purpose, numerical scripting languages, CSV import/export

Developed new database, data analytics, and information sharing technologies to meet MECO and HECO's needs

# System Architecture

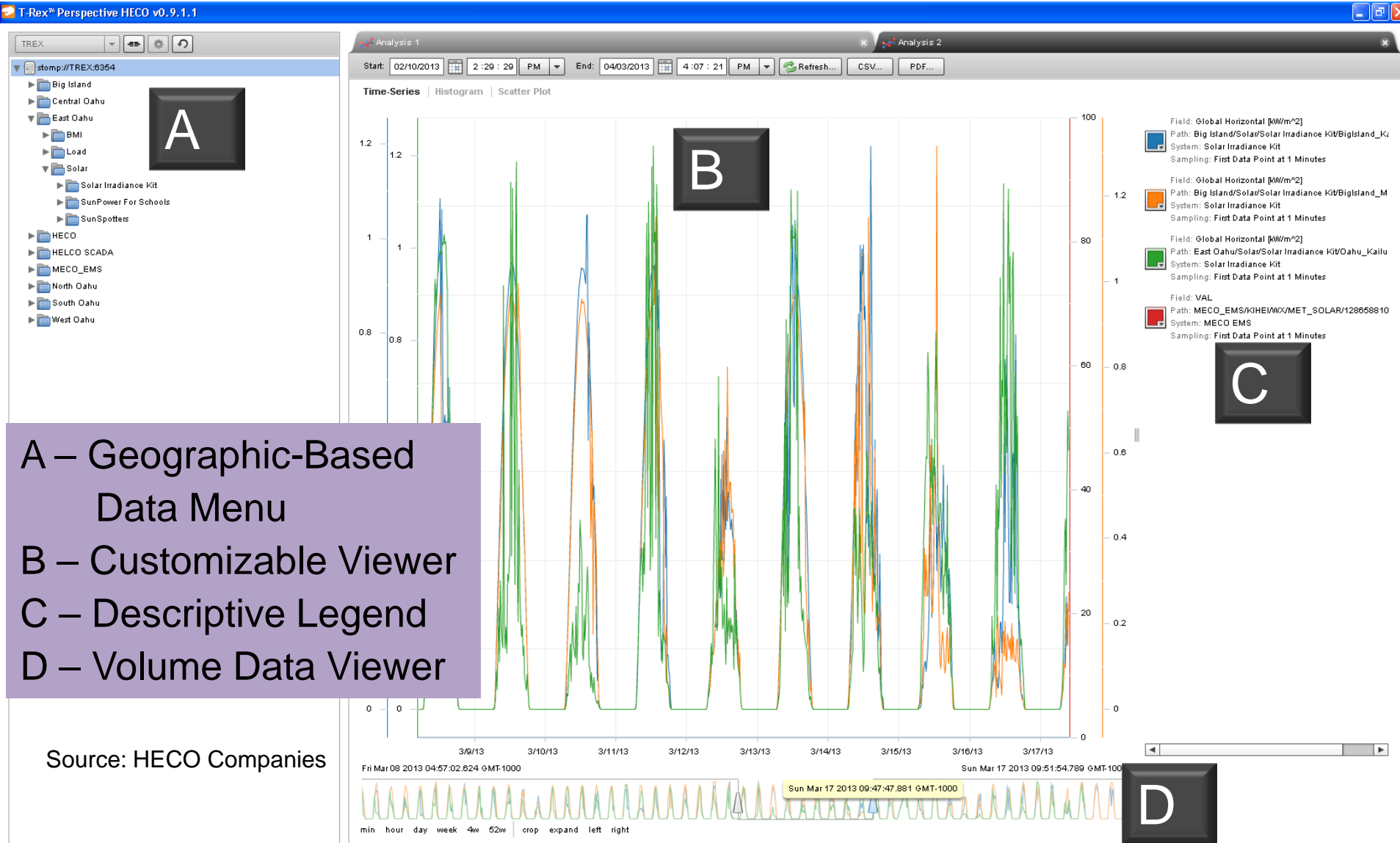


- Instances on EMS and Business Networks
- Increased EMS data archival rate from 30 to 2 seconds
- Reduced database size by 10 times (previously relational)
- Faster visualization and reporting; self-service users
- Bridging real-time data to demonstration DMS system
  
- ~10 users across operations and planning (MECO and HECO planners)

- Integrating data from ~10 different renewable data sources
- 20 users across three different planning groups
- Bridging data to partners
  - AWS TruePower renewable generation forecasting
  - Distribution network model building and validation
  - Bridge forecast results to Siemens EMS (upcoming project)
- Power users in renewable planning developing custom applications and analyses for other users
- Many more “indirect” users at both HECO and MECO
  - Internal and external decision makers and analysts who use exported data products and reports



# TREX Perspective View to Renewable Data



- A – Geographic-Based Data Menu
- B – Customizable Viewer
- C – Descriptive Legend
- D – Volume Data Viewer

Source: HECO Companies

# Sharing Renewable Resource Data with the Public

HECO Renewable Re x

localhost:8080/trex-webapp/search.jsp

Home View Data (0) Download Data (0) Empty Cart

11/01/2012 - 11/06/2012

Reset map over Oahu

search term

Bookmark URL

+ Region

- Data Source

10 count

SunPower For Schools (1060)

NREL (295)

Solar Irradiance Kit (18)

- Site Name

4 count

Castle High School (260)

McKinley High School (160)

Kalaeloa (136)

Waipahu High School (100)

+ Sensor Name


- Engineering Units

4 count

watts per square meter (257)

meters per second (257)

kilowatts (257)



Map legend:

- NREL
- SunPower For Schools
- Solar Irradiance Kit
- Multiple data sources

Map controls: +, -, x, ?

5 Date

Data source: **Solar Irradiance Kit**  
 Site name: **Oahu Mokapu**  
 Sensor name: **Global Horizontal [kW/m<sup>2</sup>]**  
 Date: **11/06/2012**  
 Minimum Value: **0**, Maximum Value: **0.998**, Average Value: **0.1823**

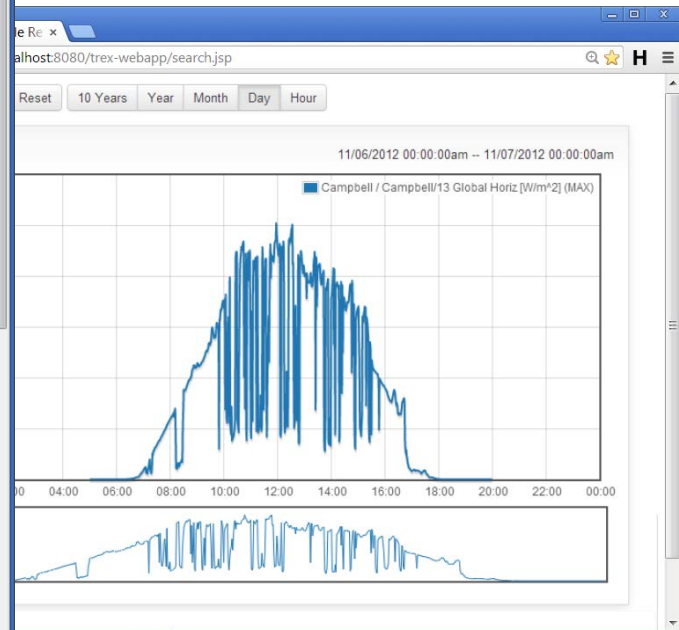
Add to cart  
Center on map

Data source: **NREL**  
 Site name: **Campbell**  
 Sensor name: **Campbell/13 Global Horiz [W/m<sup>2</sup>]**  
 Date: **11/06/2012**  
 Minimum Value: **0**, Maximum Value: **1010.31**, Average Value: **267.894**

Add to cart  
Center on map

Data source: **NREL**  
 Site name: **Kalaeloa**  
 Sensor name: **Kalaeloa/11 Global Horiz [W/m<sup>2</sup>]**

Add to cart  
Center on map



- Hawaii based small business
- Worked with MECO and HECO since 2009
- Invaluable partnership for us
  - Domain expert users who patiently explain their work, communicate their goals, suggest features and improvements, and help to shape the solution
  - Opportunities to work with and learn from world class organizations like Alstom, AWS Truepower, Siemens, and SMUD
  - Mainland and global growth opportunities with Hawaii as a renewable integration launch pad

Extremely rewarding to be able to help groups who are in the process of solving one of Hawaii's most pressing problems

- PICHTR: Pacific International Center for High Technology Research, a Hawaii-based non-profit that has been a catalyst for technology development across the Pacific Rim since 1983. <http://www.pichtr.org/>
- Hawaiian Electric Industries
- Department of Energy
- Department of the Navy

