LE STUDIUM

LOIRE VALLEY INSTITUTE FOR ADVANCED STUDIES

“Practical Engagements and the Social-Spatial Dimensions of the Post Petroleum Future”

7 & 8 November 2016

“Hawaii’s Role In Leading the Way Towards Fossil Fuel Free Island Nations”

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WHAT IS THE HAWAII CENTER FOR ADVANCED TRANSPORTATION TECHNOLOGIES (HCATT)?

- A program aligned under the State's Business and Economic Development Department
  Part of the High Tech Development Corporation, State of Hawaii
- Established in 1993 with funds from the Defense Advanced Research Program Administration (DARPA)
- Designate the "National Demonstration Center for Alternative Fuel Vehicles"
- Key to establishing electric vehicles in Hawaii, and demonstrating electric vehicles to the U.S. Military
- Began work with hydrogen fuel cell electric vehicles in 2006
- Expanded to integration of renewable energy and renewable transportation in 2011
- Integrated renewable energy for advanced military applications in 2014
- Began demonstration of advanced microgrids using renewable energy for the U.S. Air Force in 2016

- Collateral benefits: Technology transfer to the State and Private Sectors, and demonstration of hydrogen based energy storage as a solution to complex grid and transportation challenges

Hydrogen Production

Crew/DV Bus

R-12 Refueler

Medium Wind

Net-Zero F-22 Facility

Heavy Aircraft Tug

MJ-1 Weapons Loader

10 TPD Waste to Energy

Secure Power On Demand (SPOD)

The Unique Challenges for Islands Lacking Petroleum Reserves

- Importation of energy represents a **HUGE** drain on the economy!
- Physical isolation make you vulnerable (labor strikes, embargo, disaster)
- Island nations are fragile eco-systems and often rely on tourism for export
- The grid and clean transportation are in competition for renewable electricity!
- Absorbing intermittent renewables into an established grid system is difficult driving major changes to traditional grid business models and operating procedures.
- Changes to grid design and large scale energy storage are **crucial!!!**

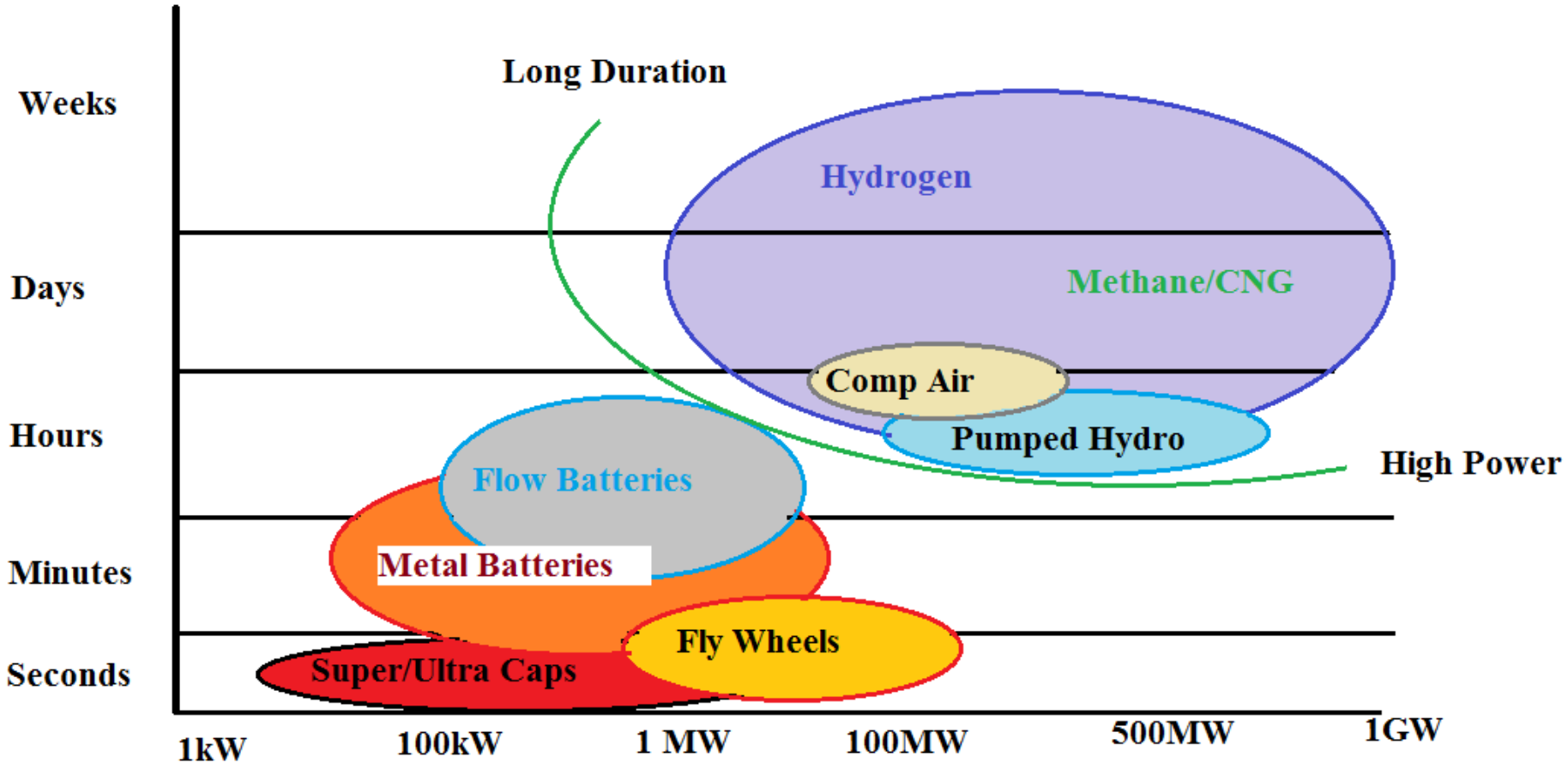
The Advantages for Islands Lacking Petroleum Reserves

- Renewable energy is typically abundant in the form of solar, wind and geothermal (ocean thermal & more) **= Energy Security!!!**
  - Tropics get the most solar exposure year round, Sub-tropics enjoy fairly consistent “trade winds”
- We **DON’T** have to fight oil and gas special interest groups!!!

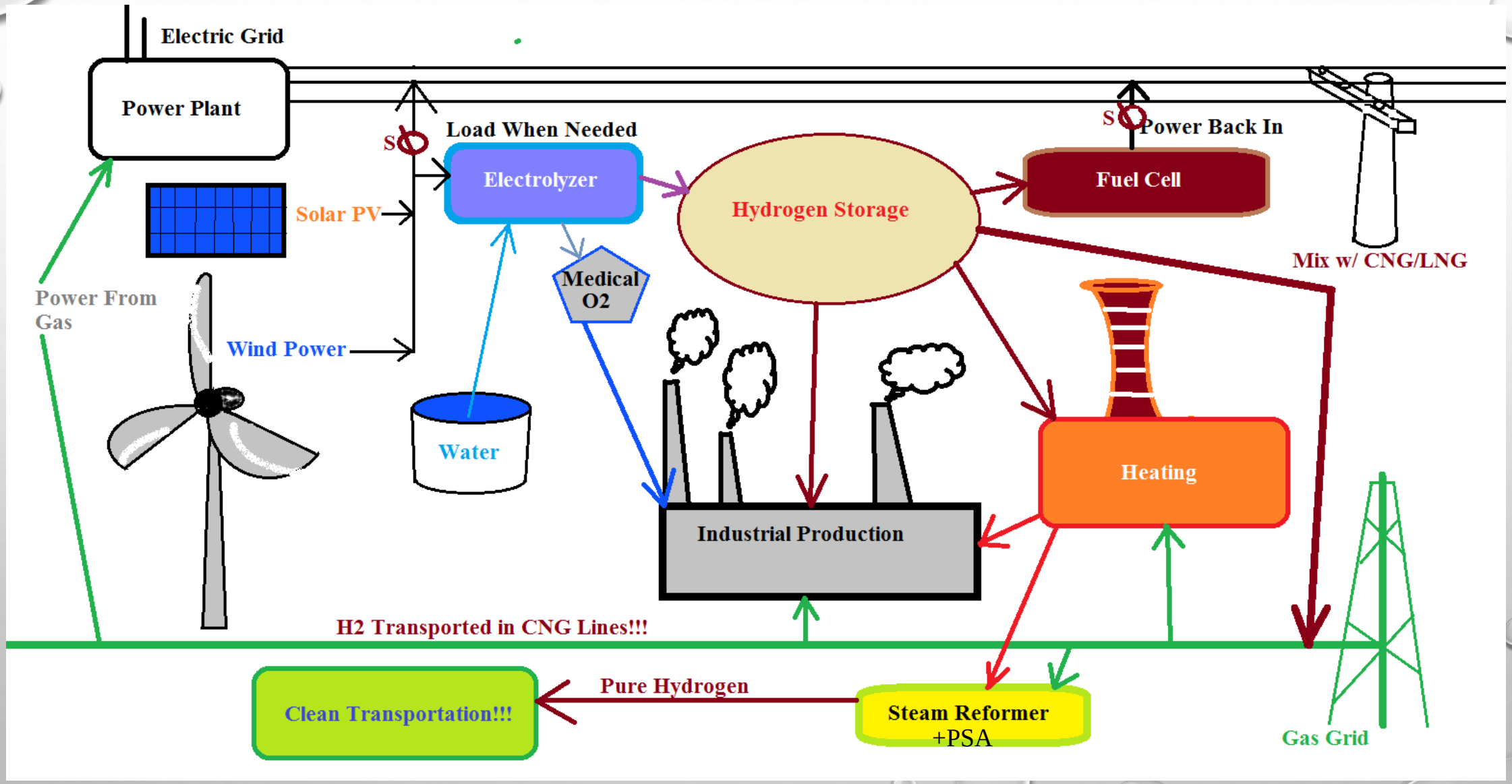
Energy Storage:
It's Not Just About Energy In & Energy Out

- There is more to energy storage:
  - Safety
  - Transportability
  - Life-cycle Costs
  - Hazardous Materials
  - End of Life Disposal
  - Availability of Raw Materials for Manufacture

Energy Storage Matrix: Power, Time, and “Fully Burdened Cost”



What Could the New Grid Look Like ?



Current Hydrogen Projects in Hawaii

- Hawaii has two operational hydrogen stations on military bases
- SERVCO Hawaii has 6 Toyota Mirai on Oahu and are building a hydrogen station in Honolulu
- Hawaii DoT is planning on converting 9 Buses to hydrogen fuel cell at the Honolulu Airport
  - They will also be building a “clean hydrogen” station
- International tour company planning a pilot hydrogen bus fleet in Honolulu by 2020
- Kunia Agricultural project incorporates PV on greenhouses making hydrogen
- Big Island buses at both Volcano National Park and municipal bus system in Kona
- Hydrogen station at NELHA nearing completion
- Several “off the grid” communities being developed on the Big Island using hydrogen storage
- Foreign Trade Zone #9 plans to convert to hydrogen powered material handling equipment
  - This also includes 5 acres of solar power to make clean hydrogen on site
- HCATT is purchasing two portable fuel cell light carts and two 5kW generators for demonstration
- The University of Hawaii has over $20M of hydrogen work being done for the Navy
- The contractor installing PV on Hawaii’s public schools is looking at hydrogen energy storage
- Our Public Utilities are considering hydrogen in their future plans!

Hawaii, and other island nations and communities, can improve our over-all economy, stabilize the grid as intermittent renewable energy is added, stop importing fossil fuel energy, create new industries and more jobs, support increased agricultural production, become more resilient after disasters, eliminate much of our greenhouse gas production, accelerate our move to electric transportation, and **do it safely,** using hydrogen for energy storage.

Hawaii leads the way for an island hydrogen economy!