



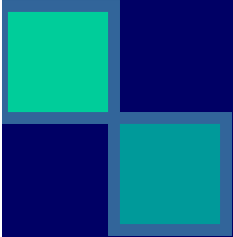

# Hawaii Energy Test Lab Advisory Group Meeting #2



WILLIAM BENNETT, Director  
Maui Community College

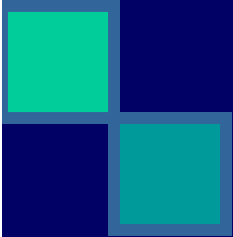



# Agenda

- 
- Welcome
  - Review of minutes & action item status
  - Meeting 1 survey results
  - Investigation Plan & schedule
  - Investigation reports
  - Discussion
  - Adjourn Meeting
- 



# Housekeeping

- 
- Please turn off or silence your cell phone
  - Bathrooms are behind me (Maui)
  - Questions are welcome from all 6 locations
- 



# Welcome

Maui Attendees

Oahu Attendees

Big Island Attendees

Kauai Attendees

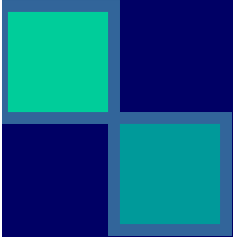

Florida Solar Energy Attendees

NREL/Sandia Labs Attendees






# Meeting Conduct

- 
- Be respectful of others
  - Give constructive feedback
  - Stay on topic – keep overall goals in mind
  - Don't talk over others
  - Side conversations outside/offline
- 

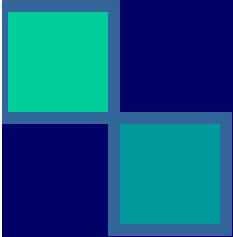



# Review of Minutes & Action Item Review

- Does anyone have comments on the minutes sent out after July 6? Copies are available.
  - Action Item Report
    - Hot water usage by family size
    - Series vs. parallel collector connection
    - Collector performance vs. orientation
- 

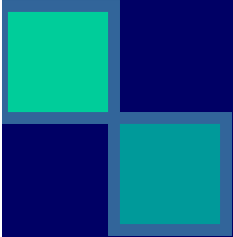


# Technical Committee Update

- 
- Charlie Cromer from FSEC added
  - Solar contractors on Maui added
  - Technical committee invited to Advisor Group meetings
- 

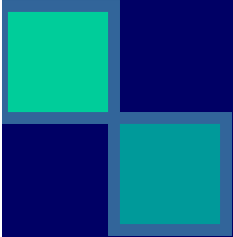



# HETL Staff Update

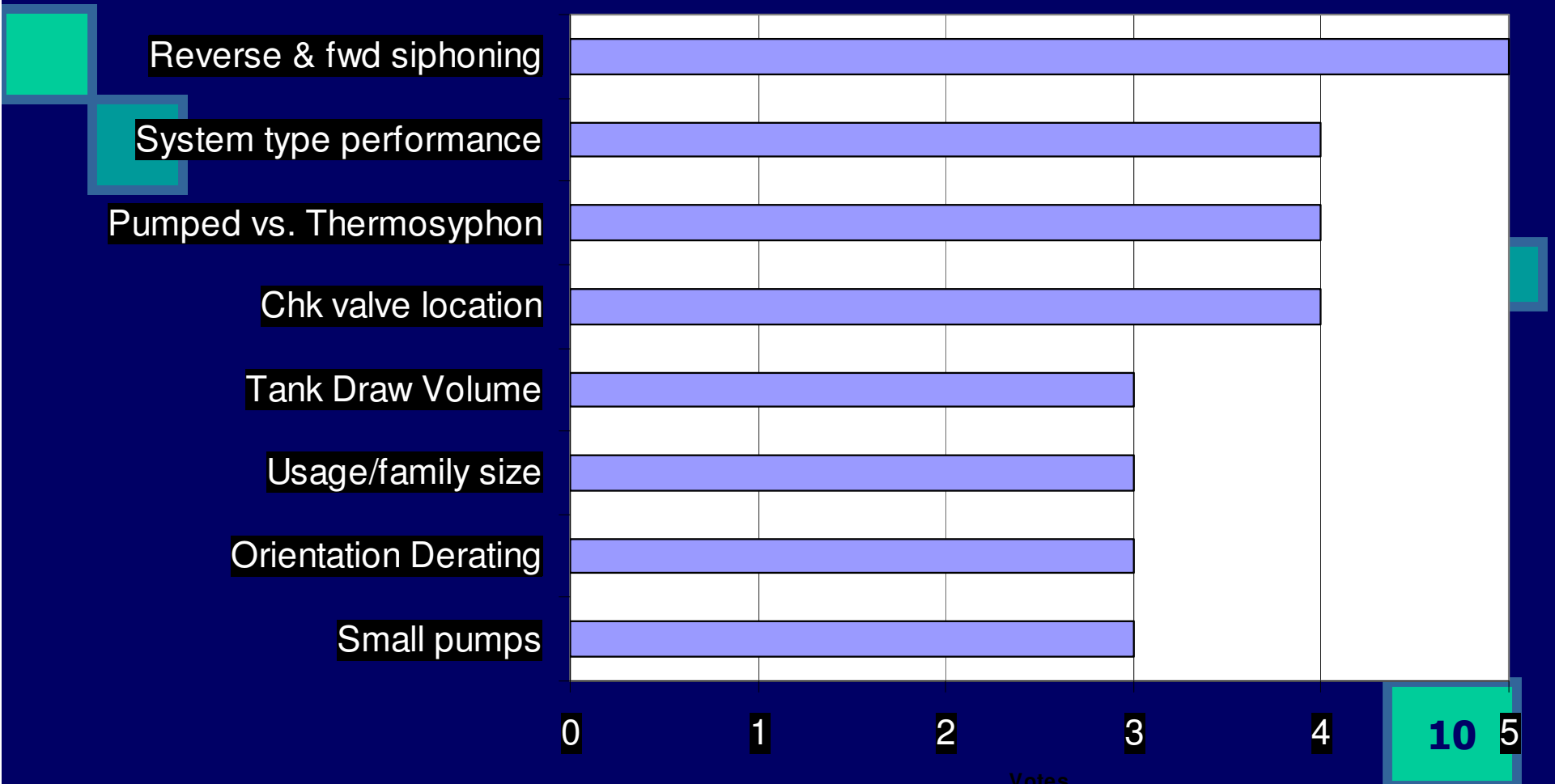
- 
- Teri Mister is the new Manager
  - 5 Interns are on staff



# HETL Status

- 
- 2005 funding became available October 1
  - Equipment has been ordered
  - First official test scheduled November 28
  - Preliminary investigations in process
- 

# Survey Results (11 voters)



# Contractor & Supplier Priorities (6)

Chk valve location

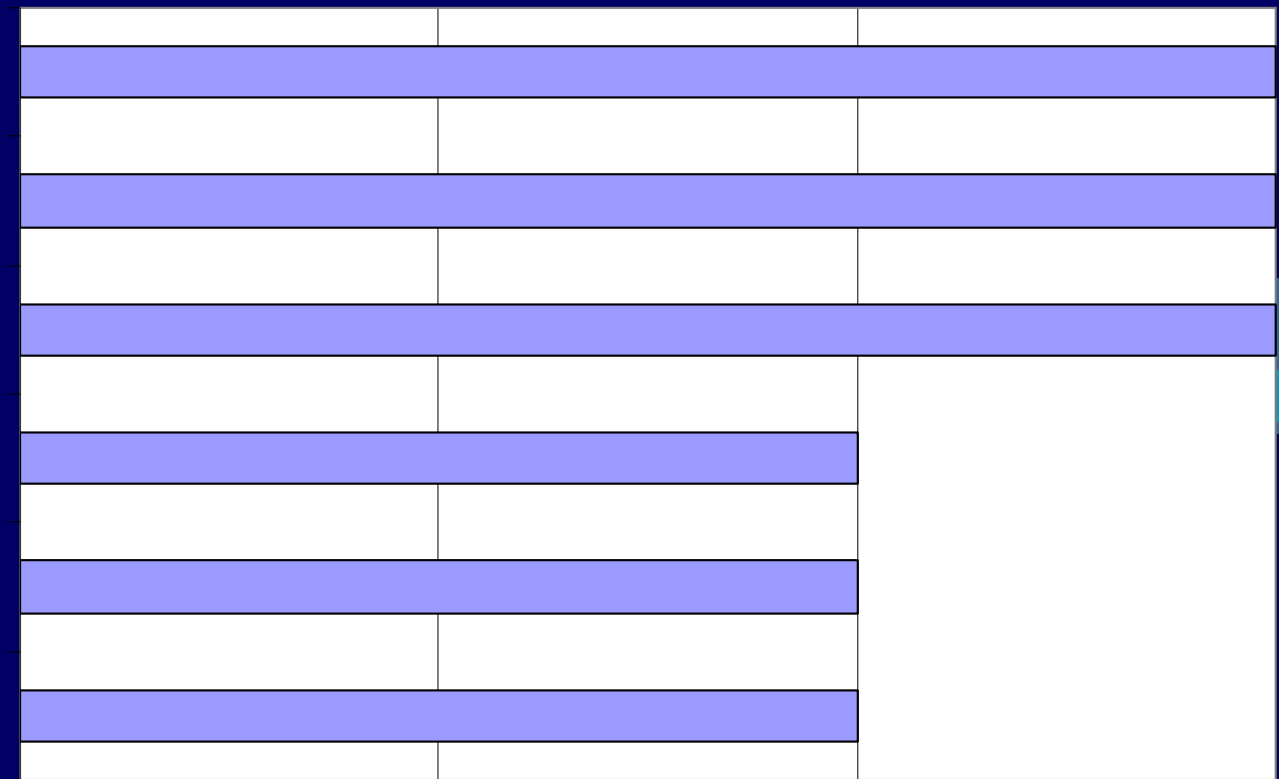
Larger tanks

System type  
performance

Pumped vs.  
Thermosyphon

Reverse & fwd  
siphoning

Small pumps



0

1

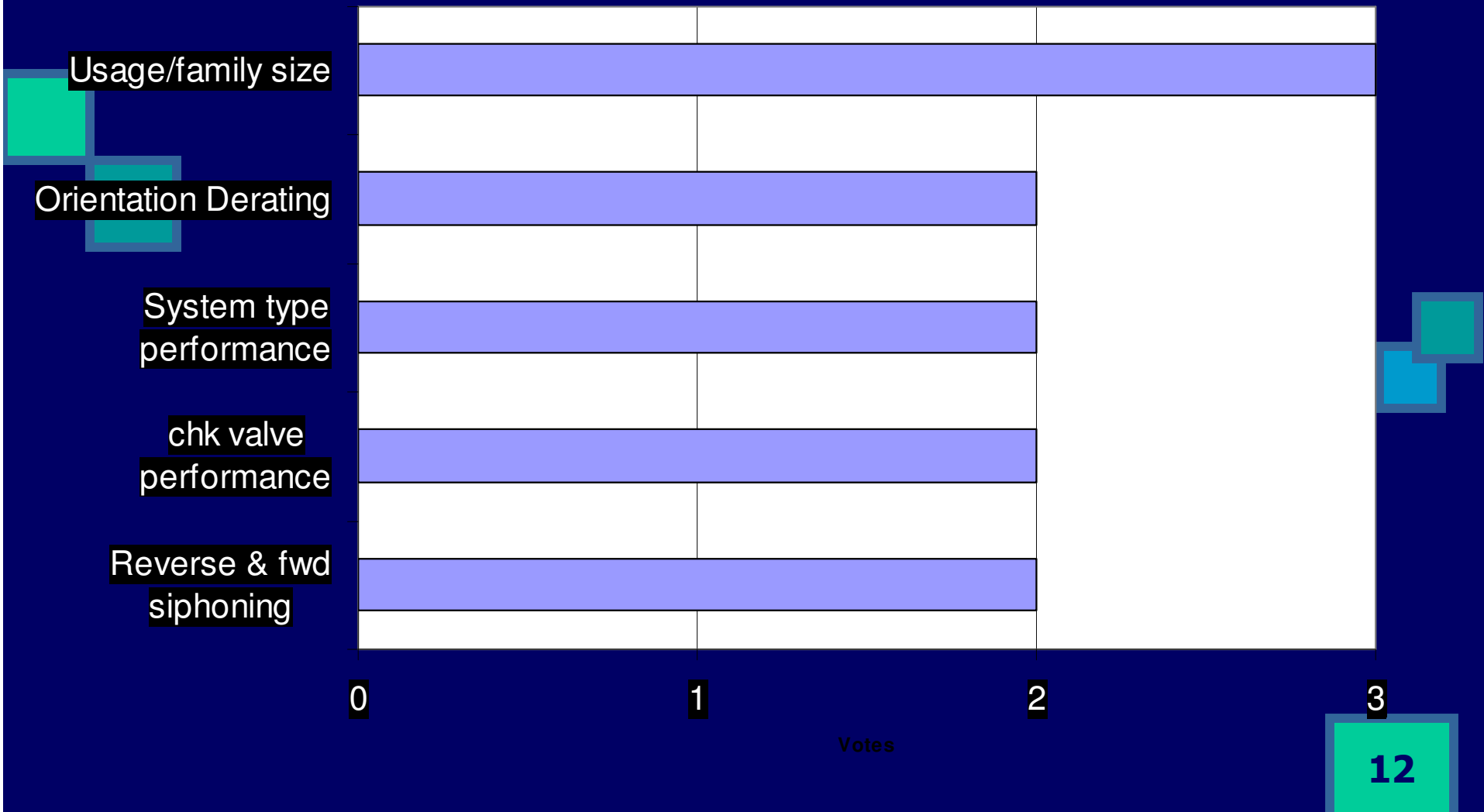
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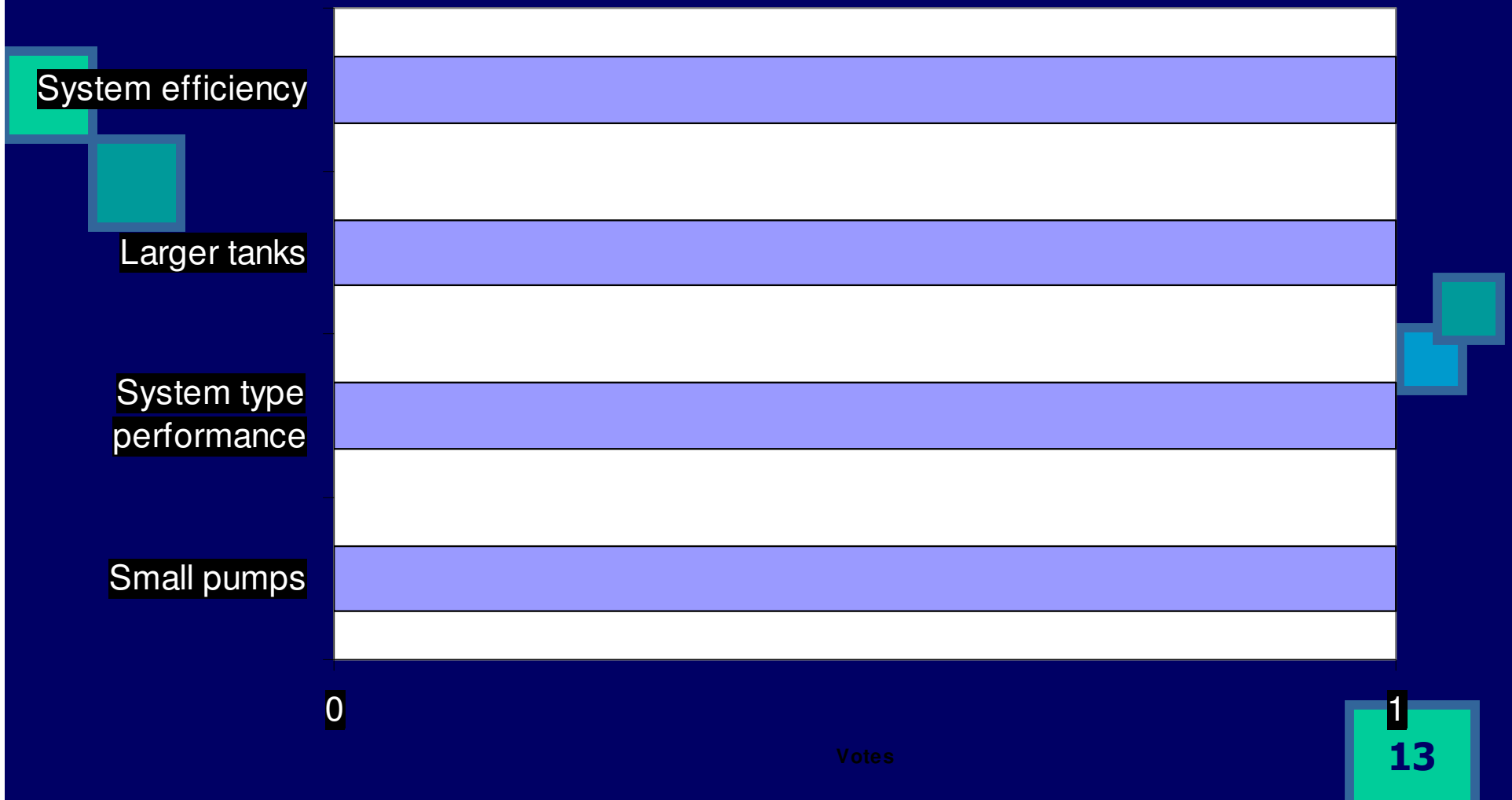
Votes

11

# Utility Priorities (4)



# Hotel Manager Priorities (1)






# Investigation Plan Designed to the Survey Priorities



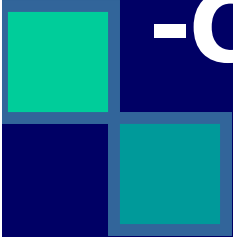

- Lab Setup

- Determine actual tank capacity (gallons)
  - Determine hot water storage capacity (Q1)
  - Select a Hawaiian draw profile (Q20)
- 



# Investigation Plan

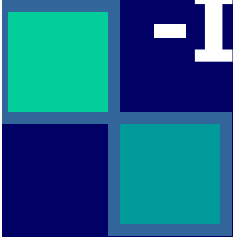

## -Check Valve Tests

- 
- Single Tank Test comparison (11/28)
    - Pumped systems only at this time
  - Comparison with failed check valve (12/12)
  - Find valves to stop fwd siphoning
  - Test the best of those valves
  - Monitor field installed valves
- 



# Investigation Plan

## -Investigations

- 
- Hot water usage vs. family size (Q2)
    - Involves review of data only
  - Off-orientation computer simulations
  - Plan lab modifications for pumped vs. thermosyphon test
  - Plan residential & commercial solar monitoring
- 



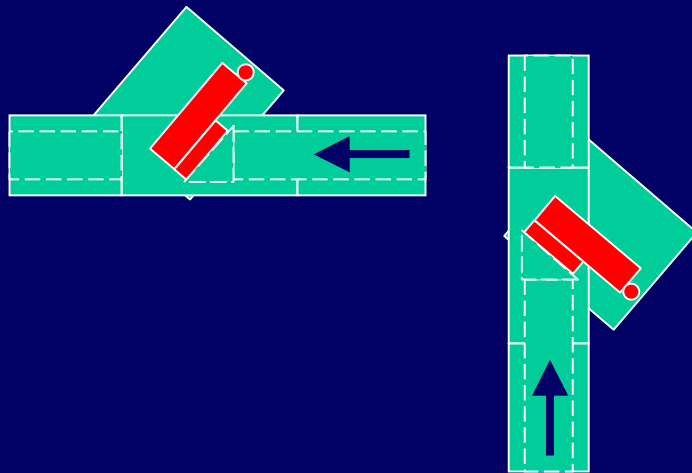
# Preliminary Investigation Reports

- T-Type Check Valve
- SOLAR check valve
- Sensor Placement
- Orientation Derating

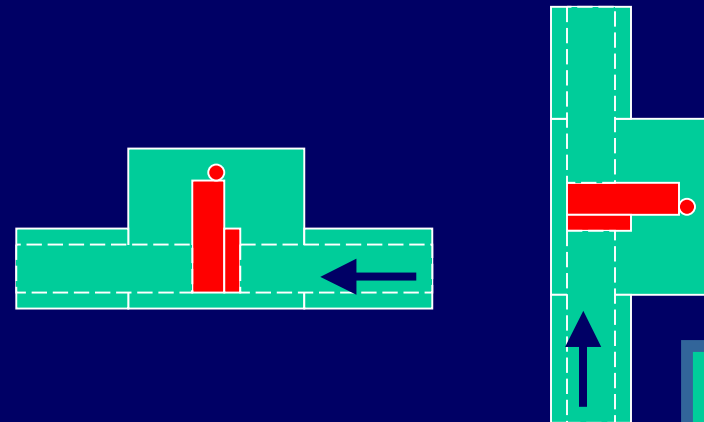
# T-Type Check Valve Report

- Check valve Diagrams

Y-Type




T-Type



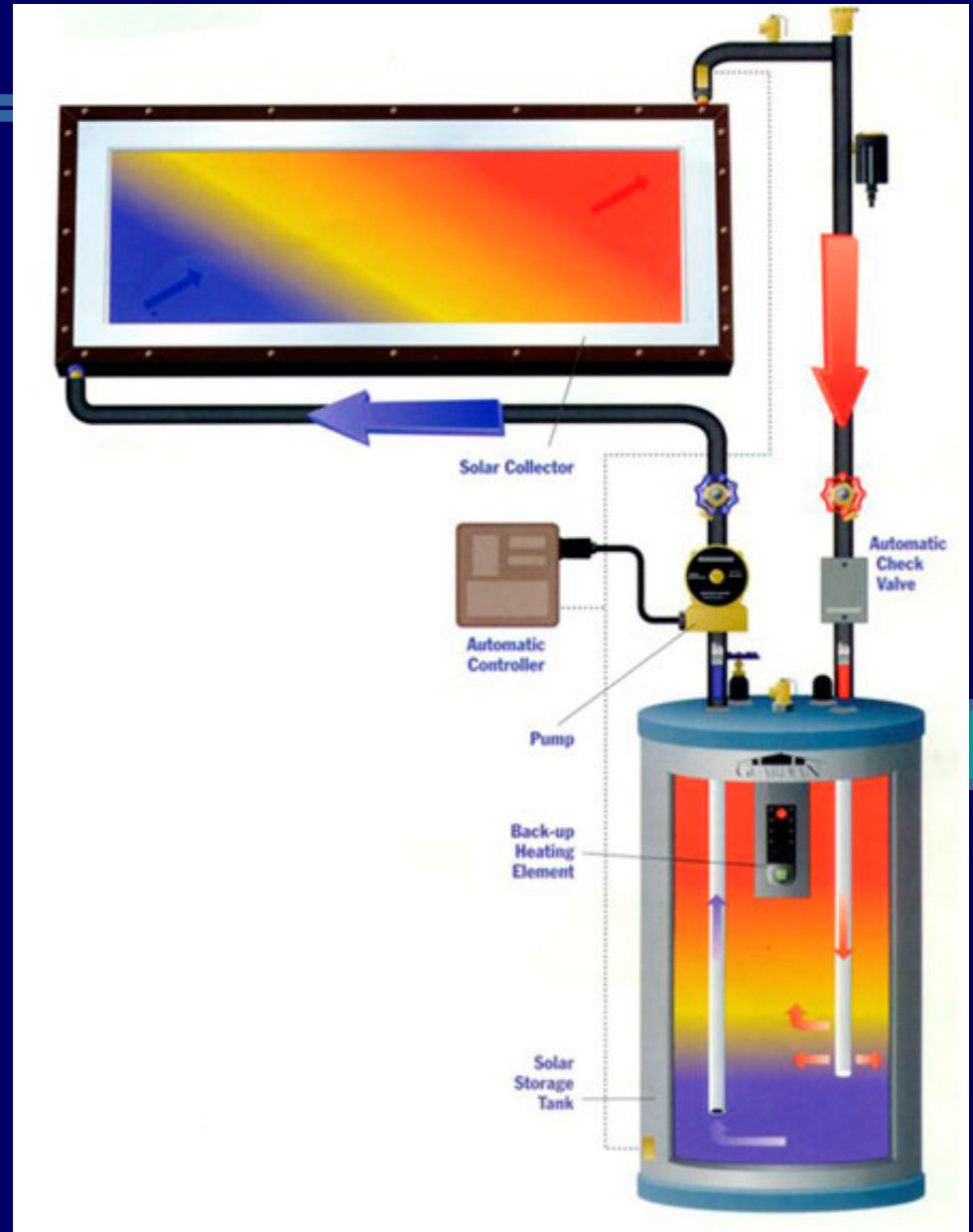




# T-Type Check Valve Report


- Lab tests and monitoring showed:
    1. Horizontal installation with top connect single tank allows forward siphoning
    2. Horizontal installation with bottom connect double tank allows forward & reverse siphoning
    3. Vertical installation on the solar feed pipe works until the valve sticks open.
- 

# Charlie Cromer's Suggestion

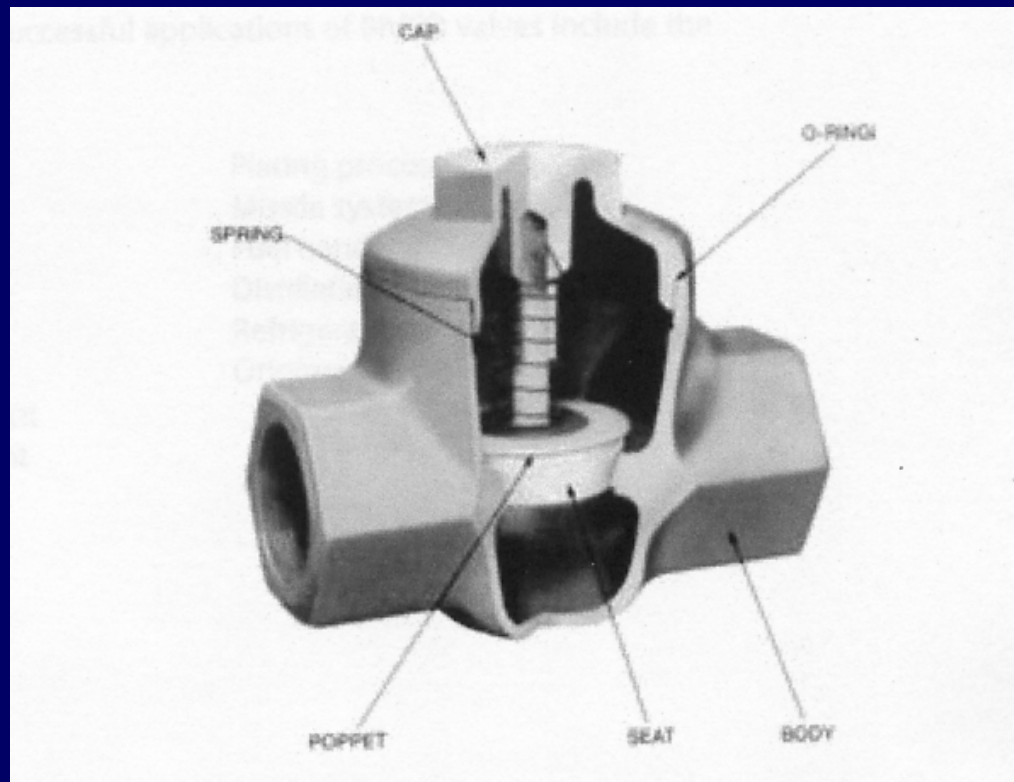




# Recommendations – Two options

1. Use the bottom connect system on single tank systems
  2. Use a valve that stops flow in both directions in top connect and multiple tank systems
- 

# "SOLAR" Check Valve Report



# Top Connect "SOLAR" Check Valve Operation

Solar collector cools down at night, and stays cool all night

Hot Water Out

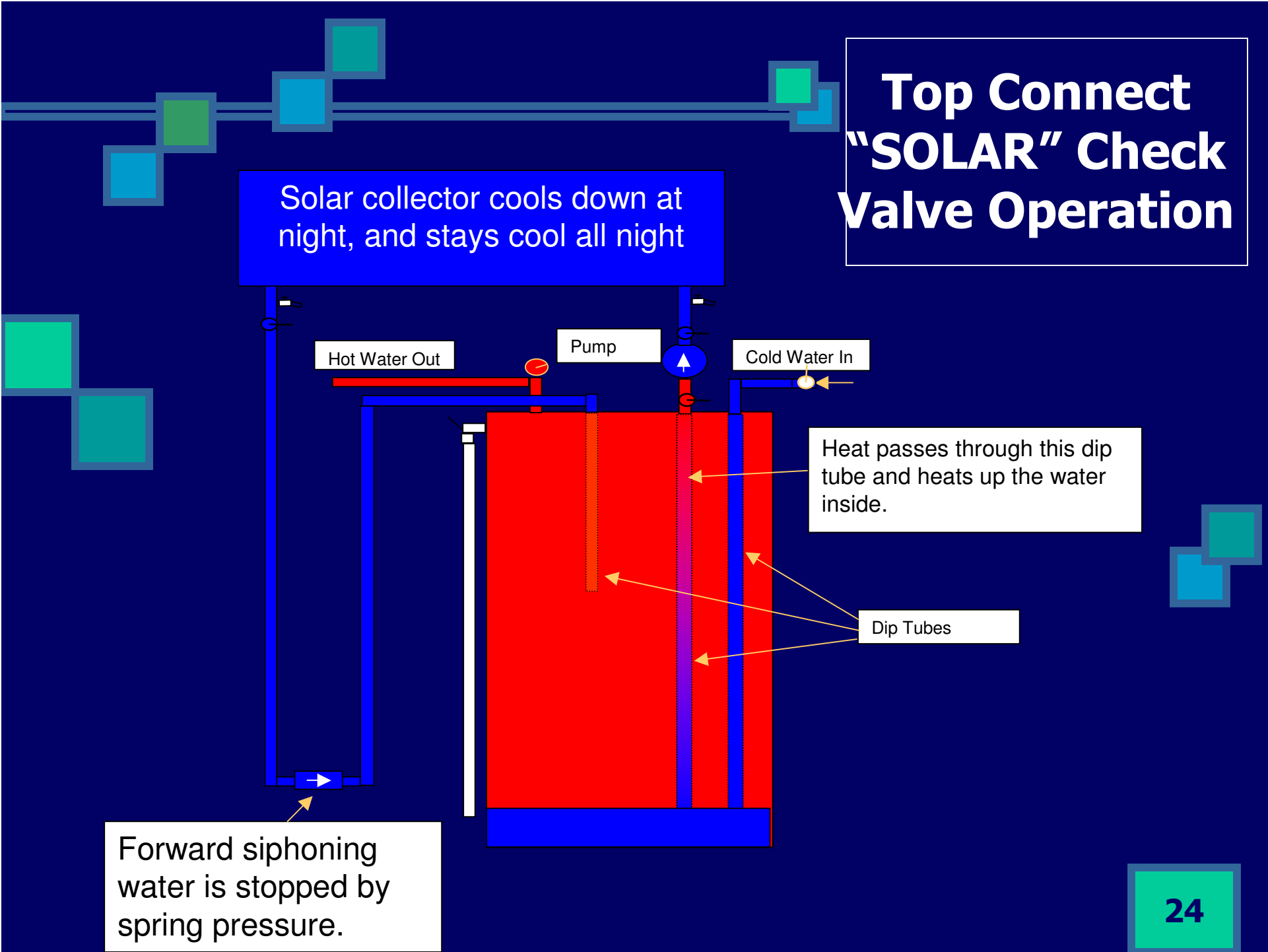
Pump

Cold Water In

Heat passes through this dip tube and heats up the water inside.


Dip Tubes

Forward siphoning water is stopped by spring pressure.



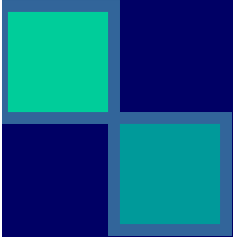



# “Solar” Check Valve Report

- Lab tests showed:
    1. A system with the prototype valve tested for 12 days showed no evidence of forward siphoning.
    2. The flow rate was reduced by 17% with a Grundfos UP 15-18 pump and 14% with a TACO 006
- 




# Recommendations

- 
- 
1. Install production valves on small top connect systems in the field and monitor performance
  2. Allow for a 20% reduction in flow rate in system designs.
  3. Test the valve with a 12 volt pump



# Sensor Placement Report

- MECO question – Where to place the tank sensor when the stud breaks off of a top connect tank
- 

# Sensor Installation Problem

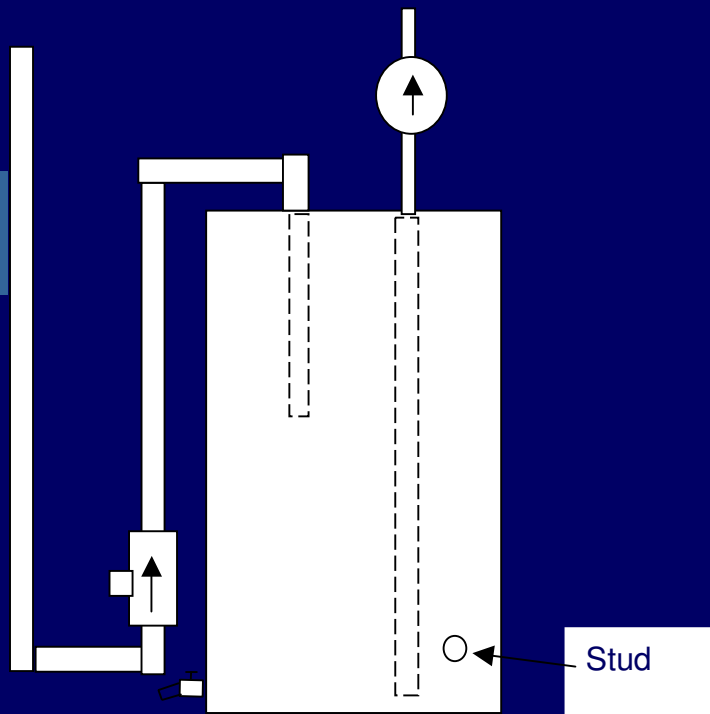


Figure 1 Top Connect Tank

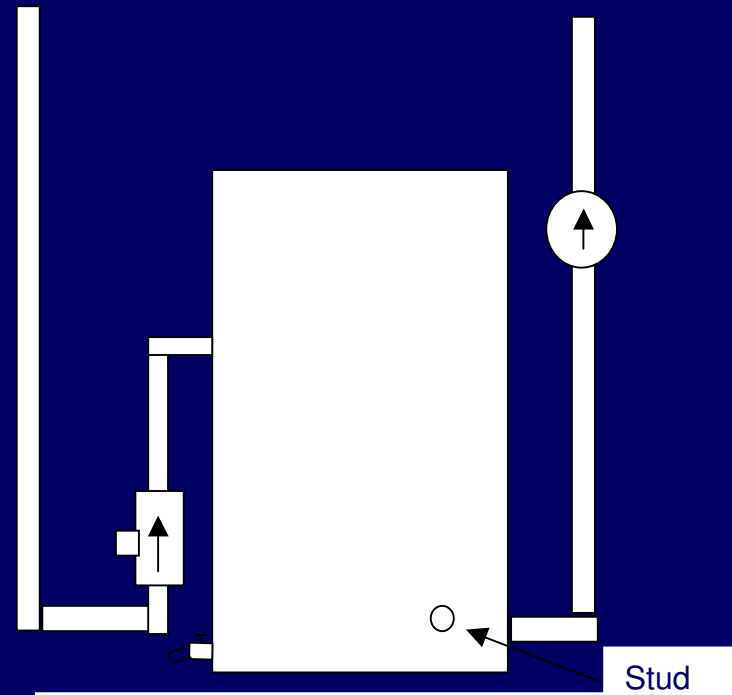
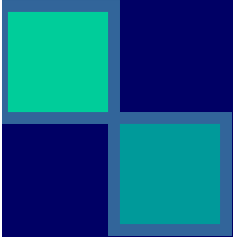



Figure 2 Side Connect Tank

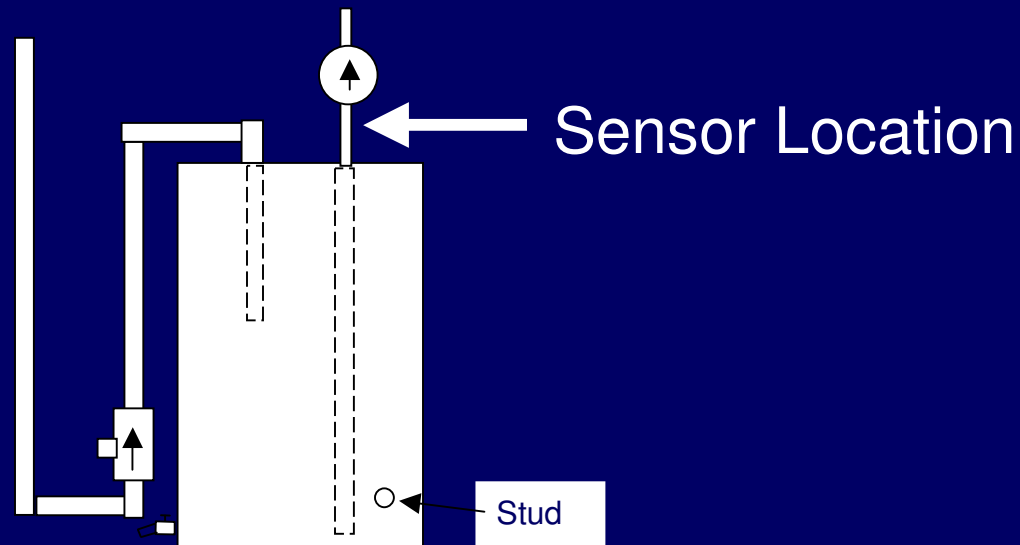


# Sensor Installation Problem

- 
- When stud breaks off:
    1. Placing sensor on pump feed nipple is still in a cold location on side connect tank.
    2. Clamping the sensor to the tank drain hose bib can result in a colder temperature being sensed.
    3. Stuffing the sensor under the insulation is not allowed by the utility standards
- 

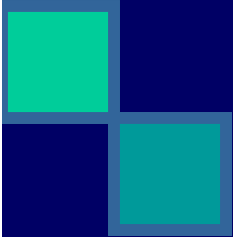

# Alternative Tested

- Clamp the sensor to the pipe under the pump (allowed by standards & specifications)





# Results of test

- 
1. Very little difference in the results
  2. Weather caused more variation than the sensor location
  3. We could not recommend against placing the sensor under the pump
  4. Side by side test using 2 top connect tanks could be scheduled
- 




# Survey on stuffing the sensor under the foam

- All contractors I contacted on Maui thought stuffing the sensor under the foam was OK
- Florida researchers and installers agreed, 1 suggested adding epoxy




## Survey, continued

- Delta T controller manufacturer recommended stuffing the sensor under the foam
  - They also are placing the sensor higher up on the tank to stop the cooling down of the tank early in the AM
- 




# Recommendations – Options

1. Clamping the sensor to the pipe under the pump is allowed by the S&S
  2. The advisory group could recommend a change to the S&S allowing stuffing
  3. We could have the contractors vote on it
  4. A test could be run with a loose sensor
- 



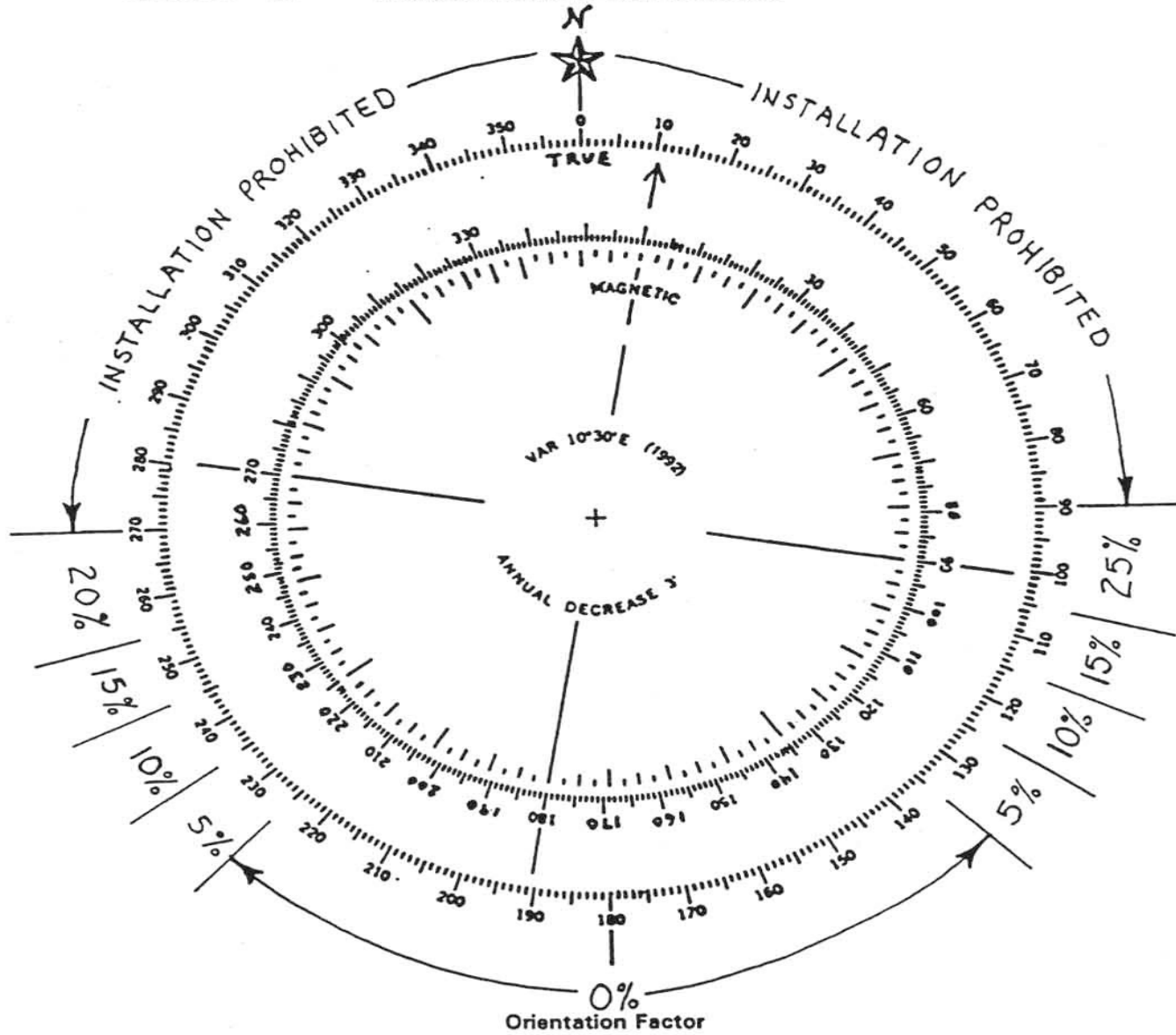
# Orientation Derating

- HECO question – Are the off-orientation de-ratings used in the Standards and Specifications correct?
  - Conducted preliminary analysis to be verified by technical committee
- 

HAWAII ELECTRIC LIGHT COMPANY  
Residential Efficient Water Heating Program

CHART 1.


Orientation Factors for Solar Installations



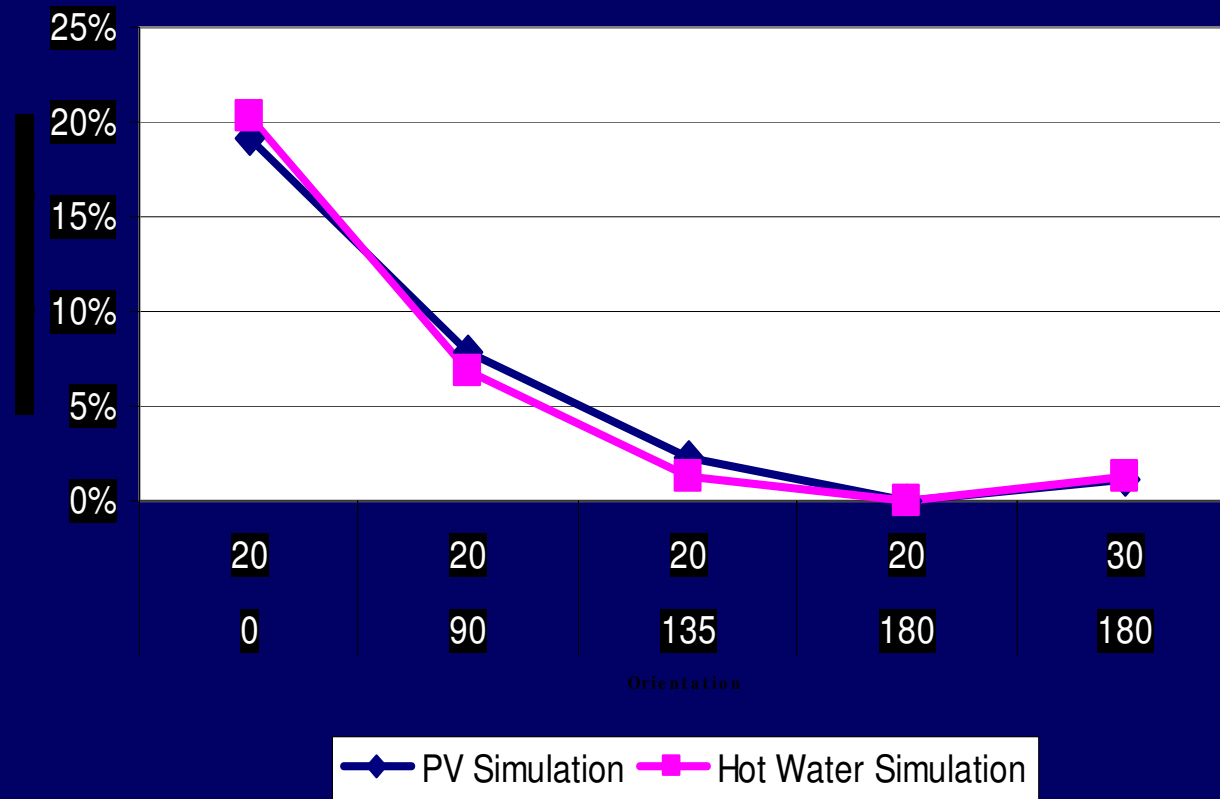
This compass rose diagram is to be used in conjunction with Table 4 and Form 1.



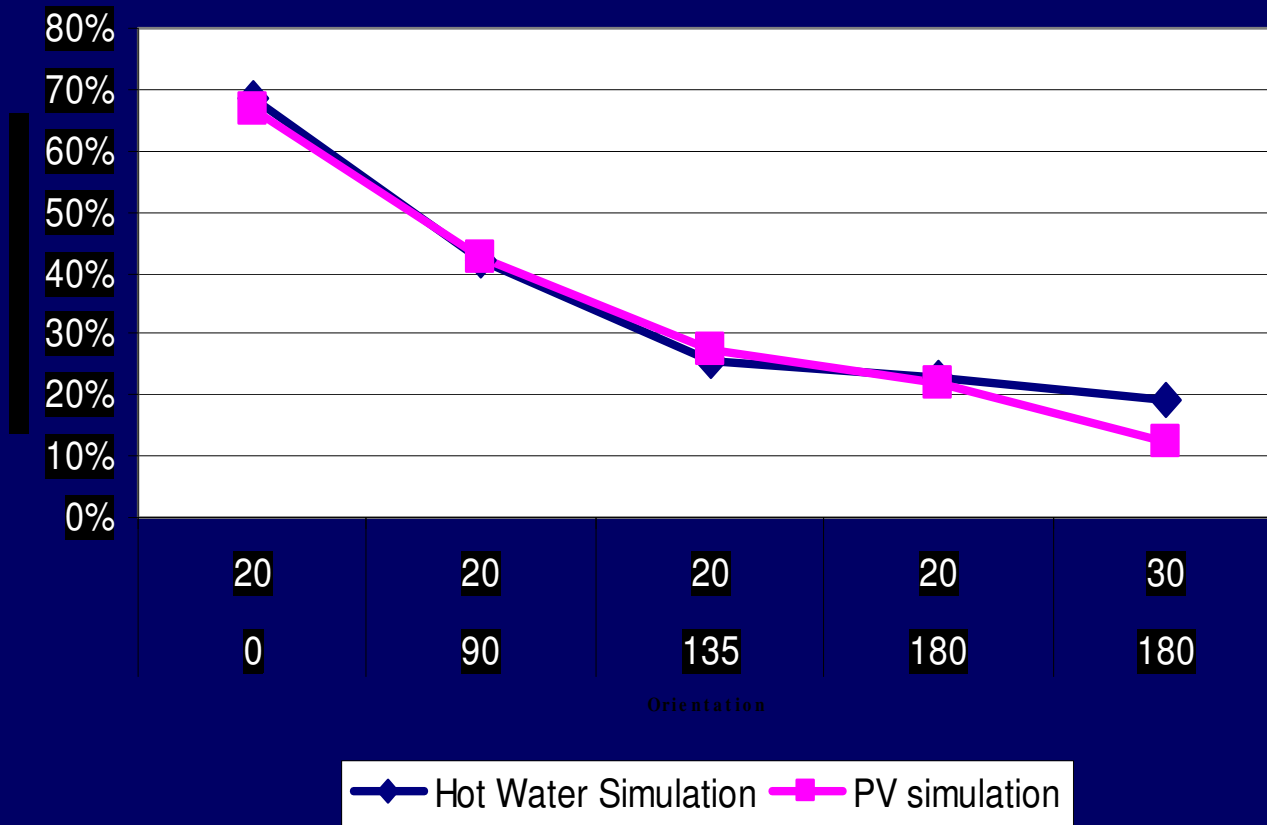
# Computer Simulation

- Compared PV Watts with Solar Pro
    1. Wanted to establish credibility of Solar Pro solar water heating simulation program
    2. Predicted kWh savings with both programs
    3. Answers were similar
- 

# Yearly savings vs. Orientation




# Summer/Winter difference vs. Orientation

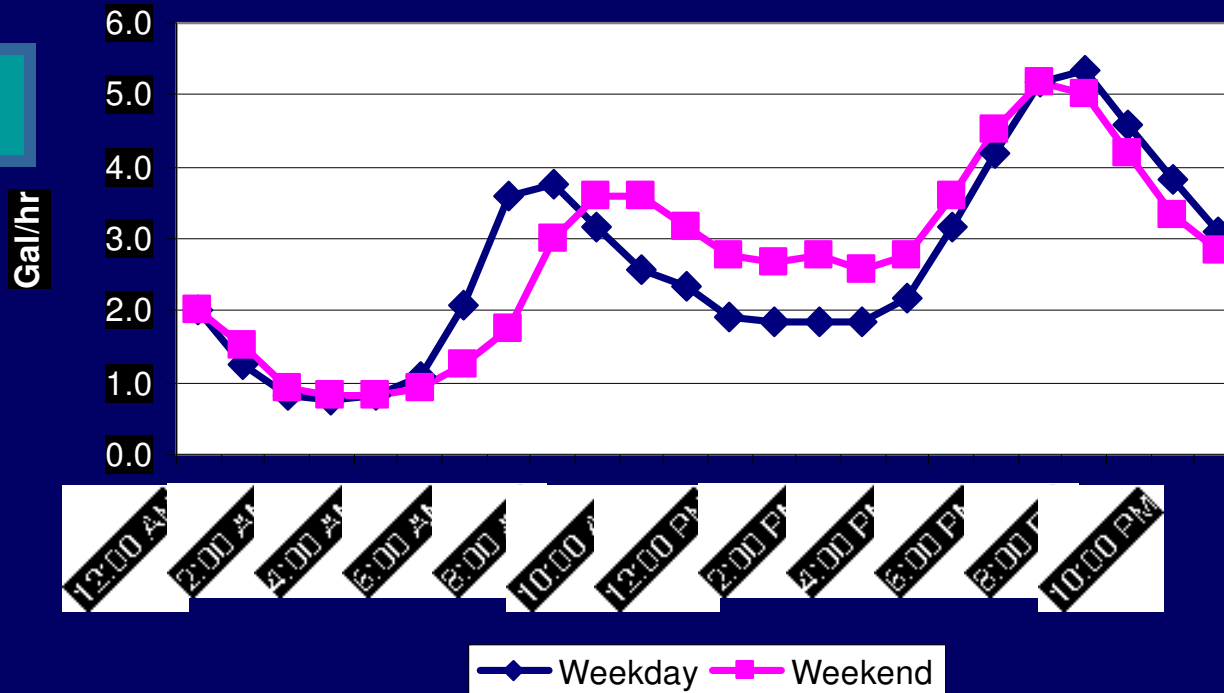




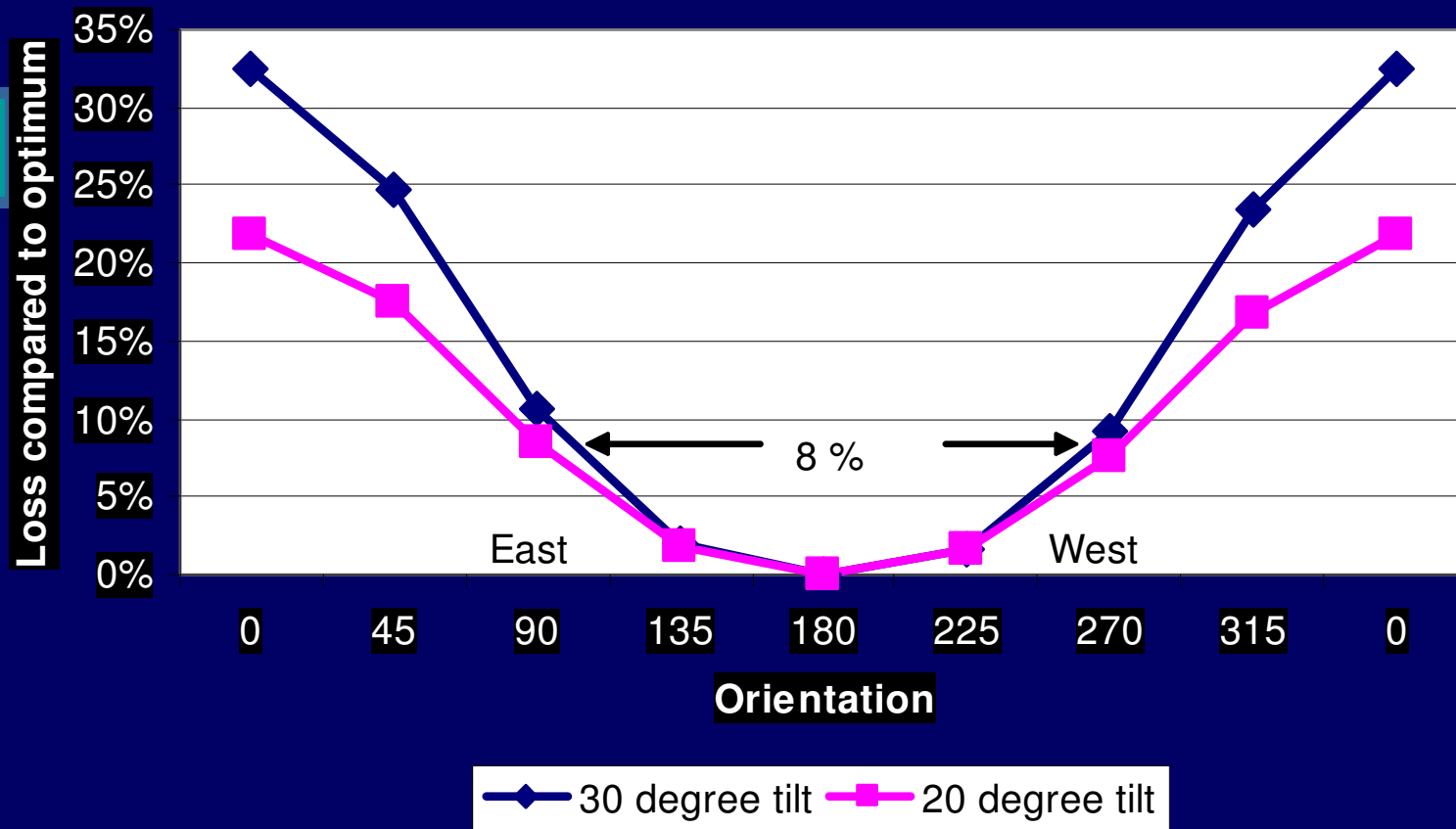
# Solar Water Heating Simulation using Solar Pro

- Simulated 64 gal/day usage at 120 F
  - Kahului weather data
  - 80 gallon tank, EP40 collector
  - B/U on at 120 degrees 4 AM to 6 AM
  - Flow Rate = 2.4 GPM
  - Tank Stratification 10 degrees
- 

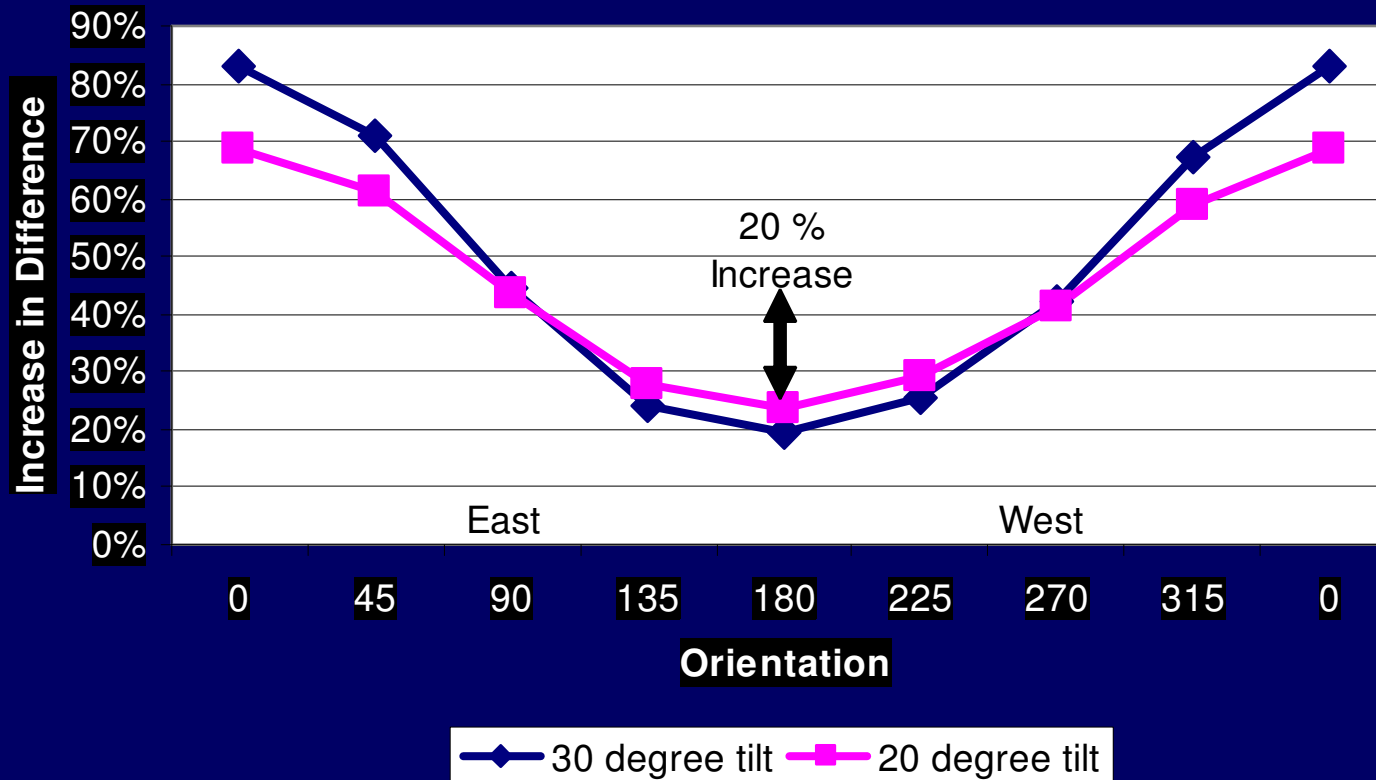
# Usage Profile from 1966 Hawaiian Measurements



# Yearly savings vs. Orientation




# Summer/Winter difference vs. Orientation






# Results of Simulation

- When collector faces East or West rather than due South:
    - Yearly savings drops 8%
    - Winter/Summer difference increases 20%
  - The S&S currently requires 20% increase in collector size if facing West, 25% for East, or tilting them South
- 




# Effect of current standards

- Increasing collector area causes higher temperatures in the summer
  - Tilting the collectors doesn't look very nice
  - Is either of these worth saving 8% more energy and decreasing the winter/summer difference 20%?
- 

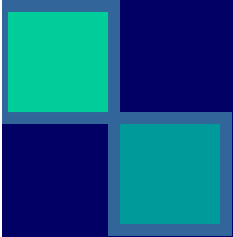


# Question

- If this preliminary data is verified:
  - What is important to each group?
    - Customers
    - Contractors
    - Utilities
    - Government
- 



# Adjourn

- 
- Mahalo for attending!
  - Next meeting January 2006
  - Minutes will be sent to you
- 