ACEEE 2008 Forum on Water Heating and Use
"Getting into Hot Water"

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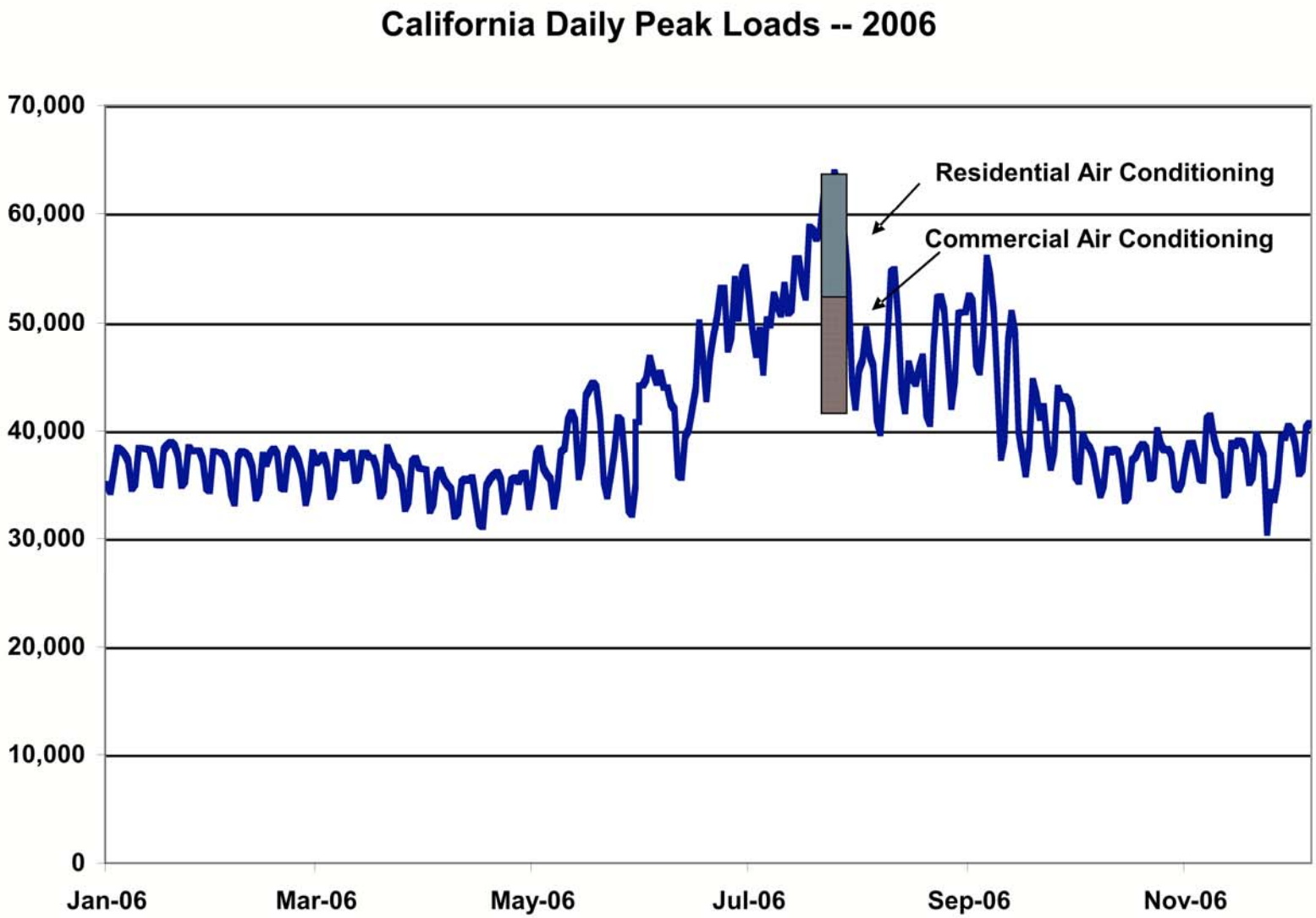
or just Google "Art Rosenfeld"

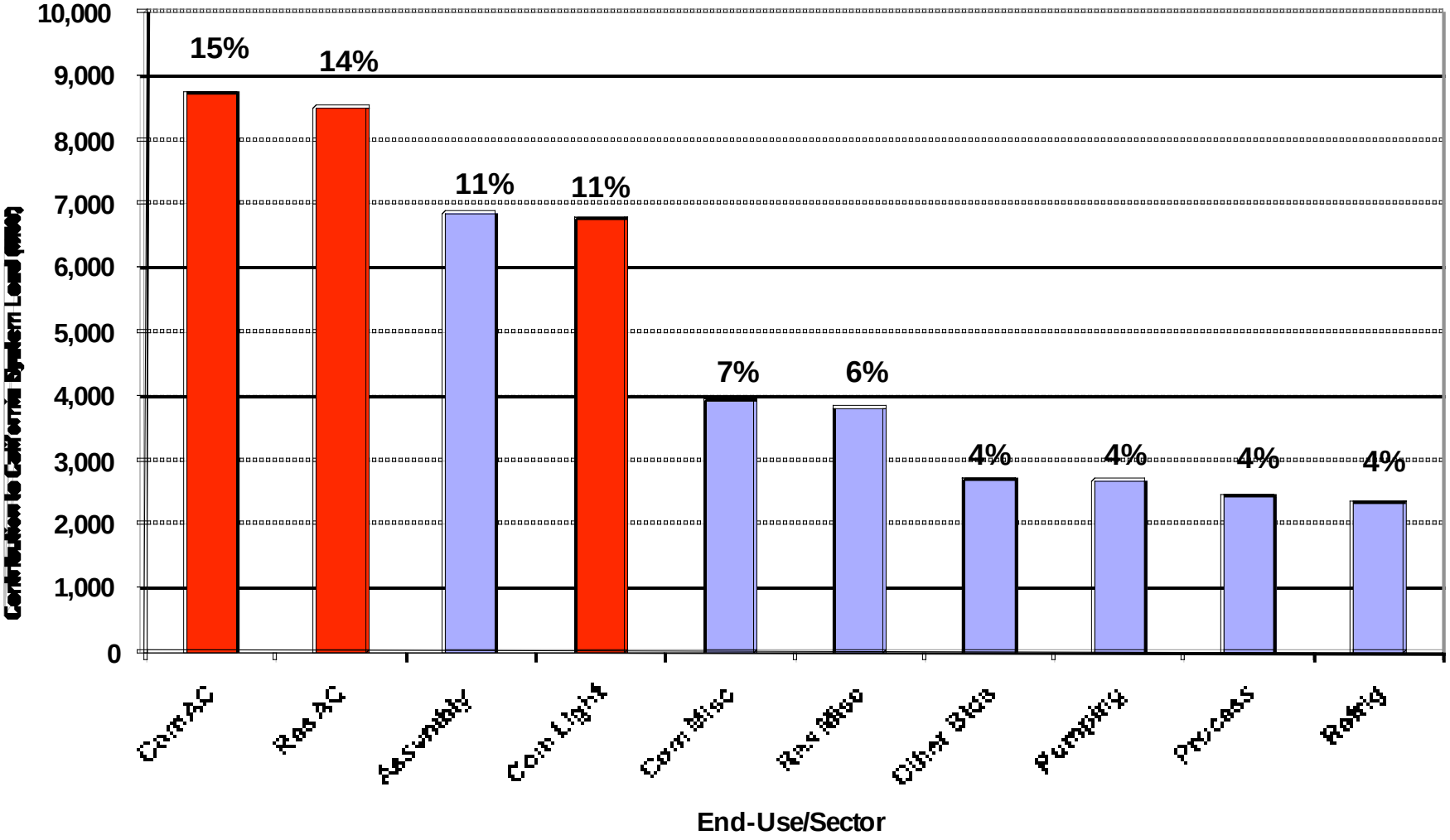
Climate Change Refugee Camp !!

- **“Time runs out for islanders on global warming's front line”**
- Rising sea levels threaten to flood many of the islands in the fertile Ganges delta, leading to an environmental disaster and a refugee crisis for India and Bangladesh
- Dan McDougall in the Sundarbans
- The Observer, March 30, 2008.

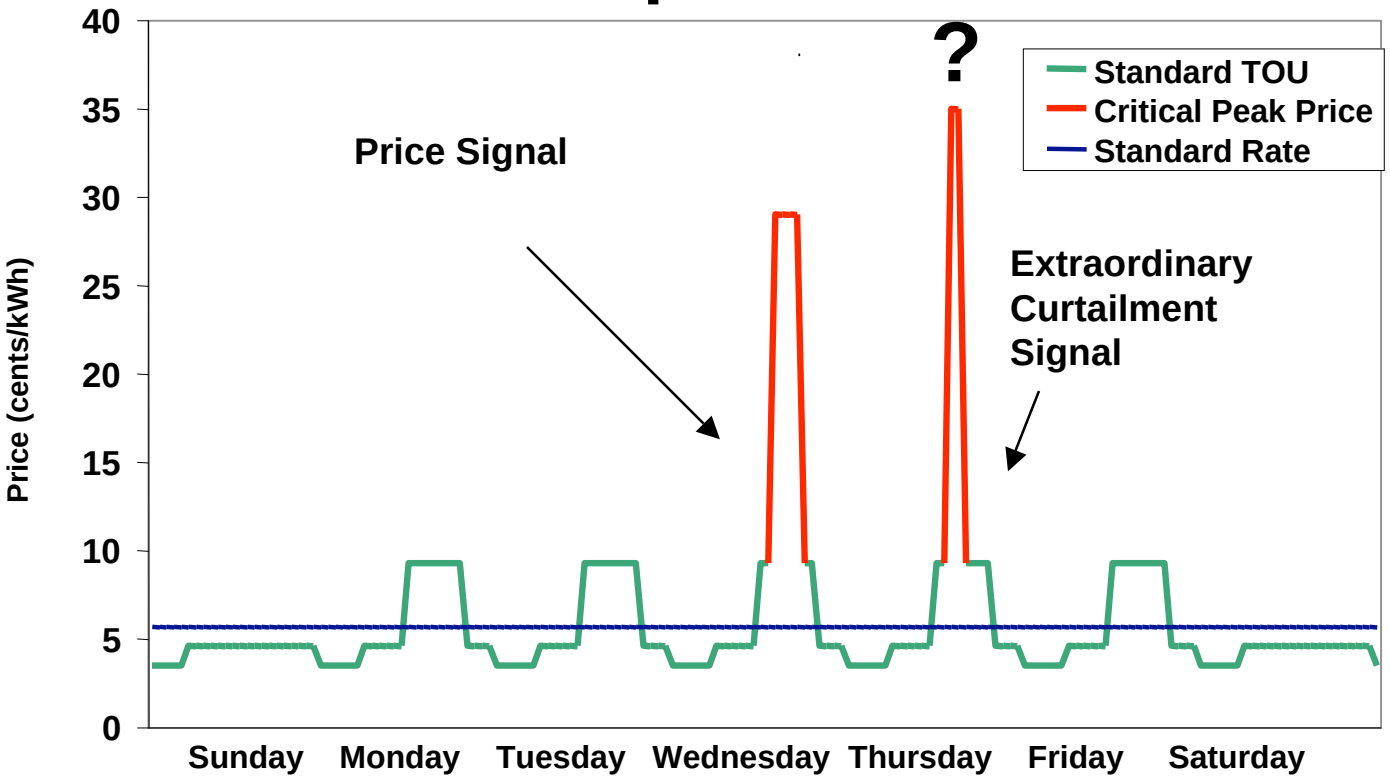
California is VERY MUCH a Summer Peaking Area



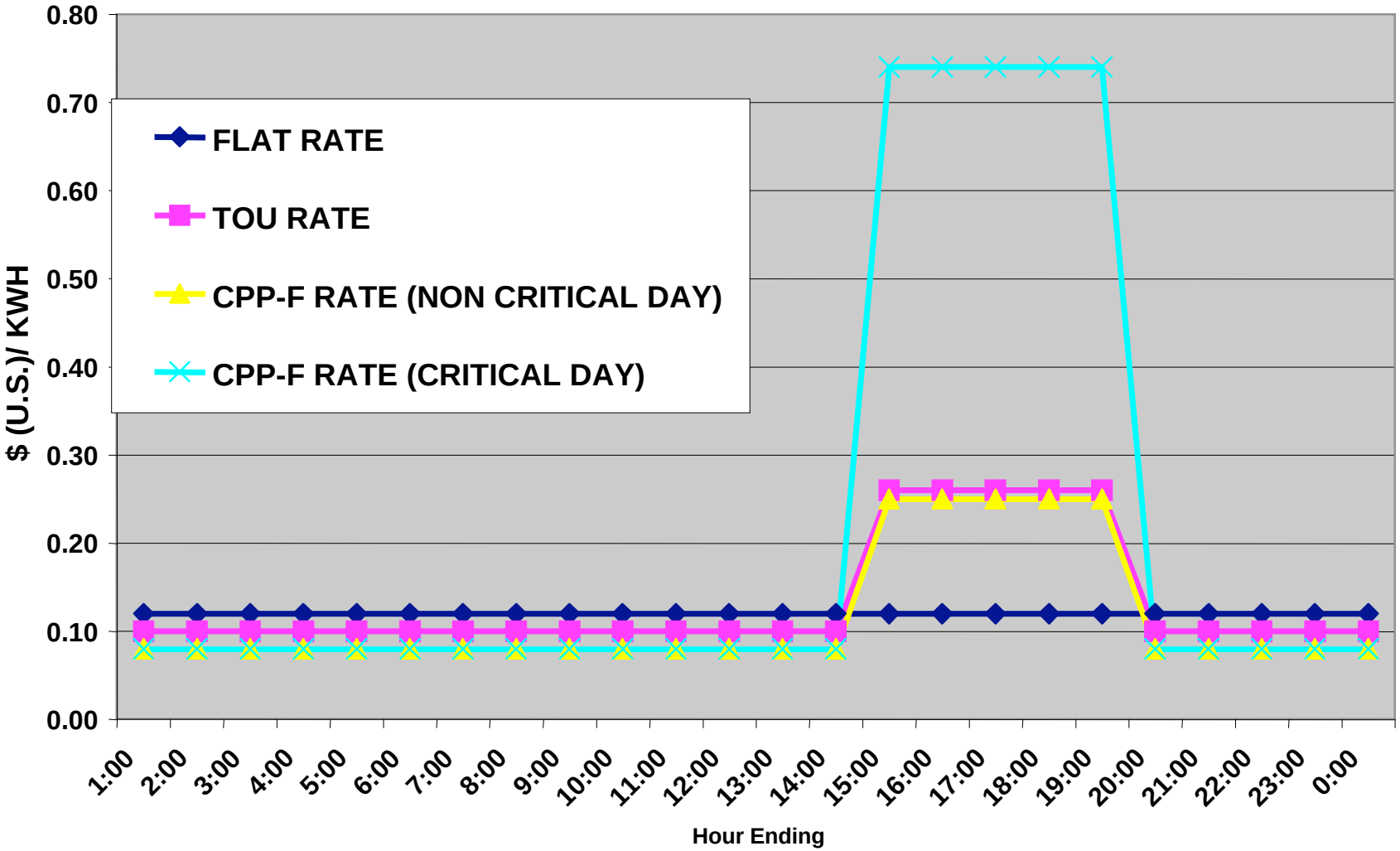
The Ten Highest Loads during the Peak
(assuming a 60,000 MW Peak)



Critical Peak Pricing (CPP) with additional curtailment option



Residential Tariffs Tested in California Statewide Pilot



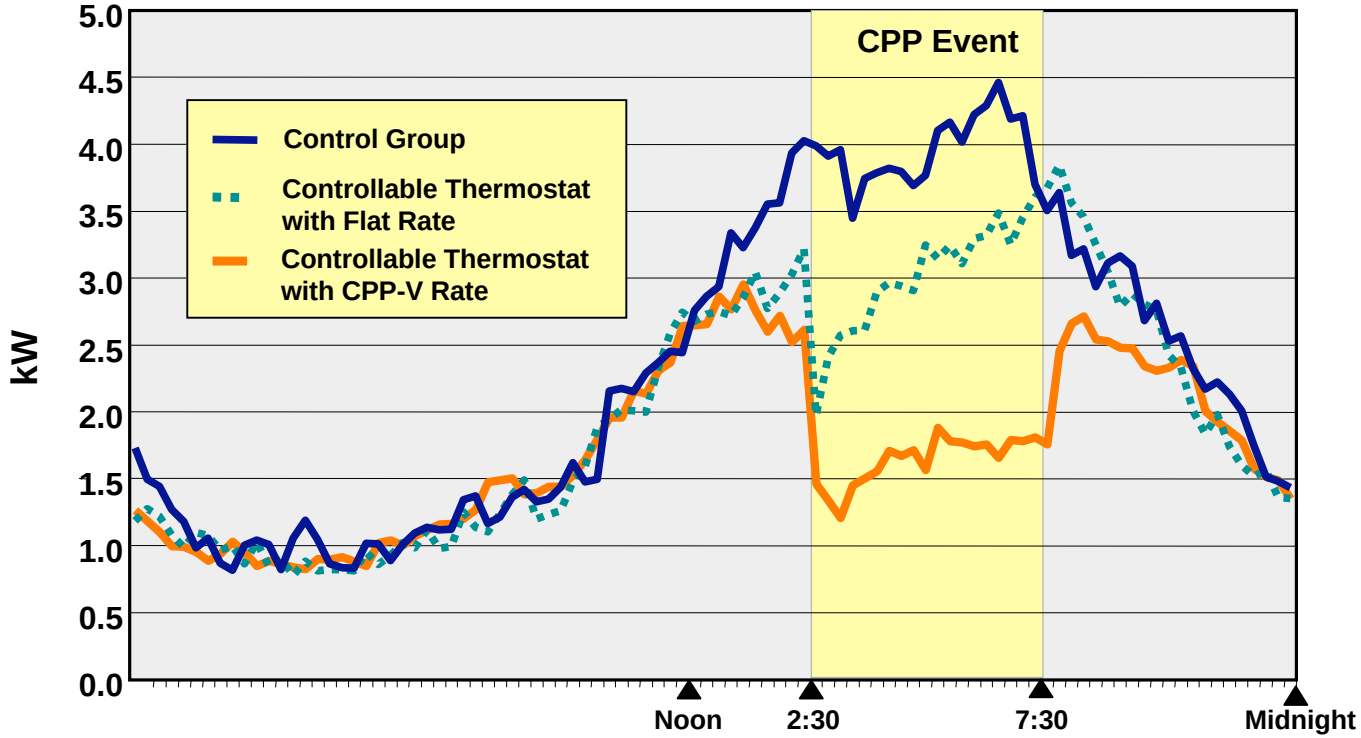
Note: Tariffs have additional tiered surcharges based on monthly consumption

CPP rates – Load Impacts

Residential Response on a typical hot day

Control vs. Flat rate vs. CPP-V Rate

(Hot Day, August 15, 2003, Average Peak Temperature 88.5^0)



Most customers (~ 80%) Saved Money and Most (~60%) thought all customers should be offered this type of rate.

Source: Response of Residential Customers to Critical Peak Pricing and Time-of-Use Rates during the Summer of 2003, September 13, 2004, CEC Report.

Small Customers Statewide Pricing Pilot “SPP”

- Results for the two-summer pilot
  - Average savings for CPP_F customers of 12% to 13% during the critical peak periods
    - CPP_F = 5 hour event; customers without smart thermostats
  - Average savings for CPP_V customers of 27% during the critical peak periods
    - CPP_V = event period varies 2 to 5 hours; customers have smart thermostats and receive signal from utility that sets-up thermostat
- Savings show little degradation from summer 2003 to summer 2004
- Savings remain nearly the same even over three-day heat events

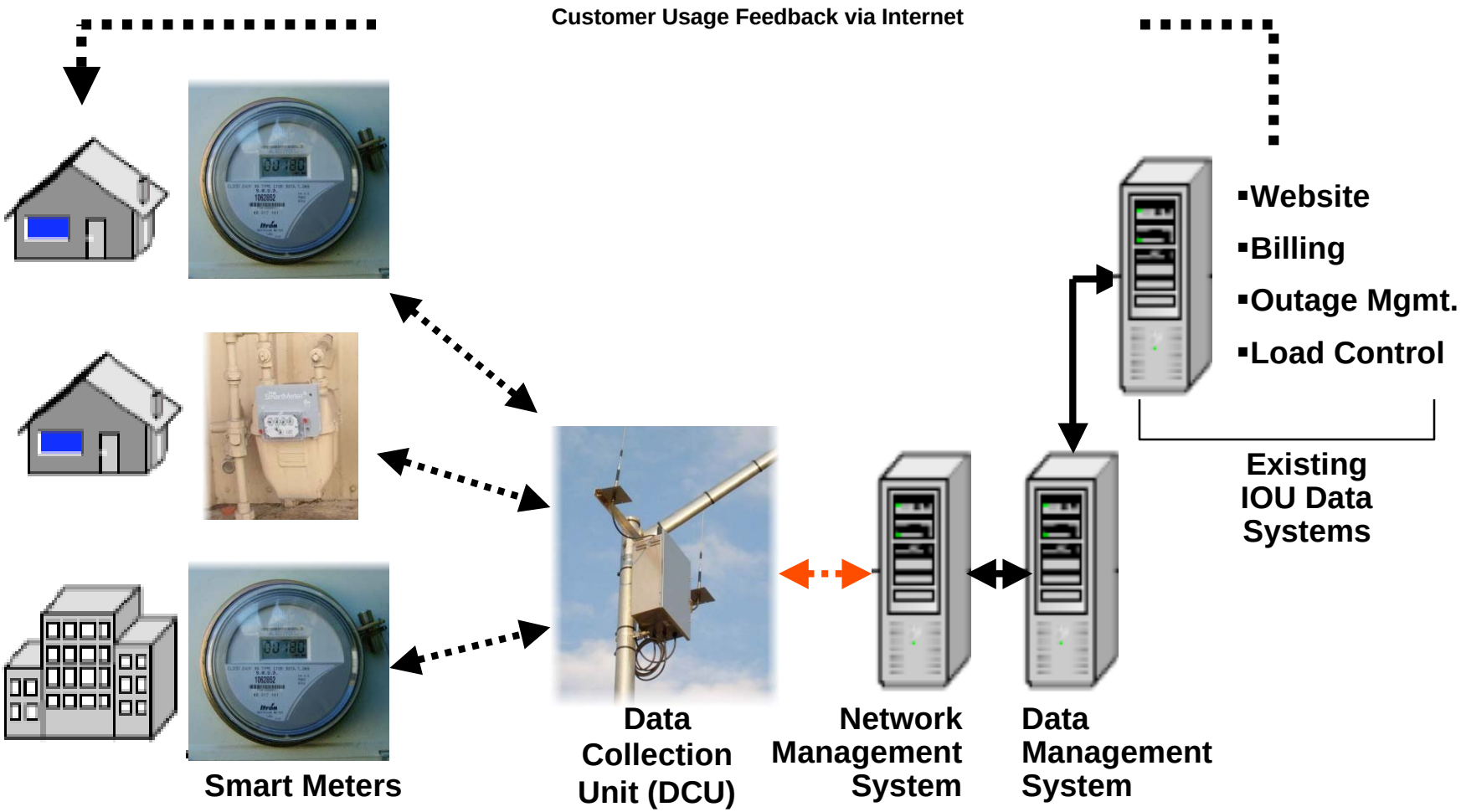
Three Necessary Components for Demand Response and Utility Modernization

- Advanced Metering Infrastructure (AMI)
  - Digital meters with communication
- Dynamic Tariffs
  - Enable customers to be able to respond to hourly prices
  - The structure of these tariffs is critically important as customers are hoping to reduce total energy costs
- Automated Response Technology at customer locations
  - e.g. Programmable Communicating Thermostats (PCTs)
    - Enable residential and small commercial customers to respond to price automatically
    - Larger customers with energy management systems linked to pricing signals over the internet or through other communication channels
- And, when coupled with energy efficiency programs and policies the result can be reduction in total consumption as well as peak period consumption

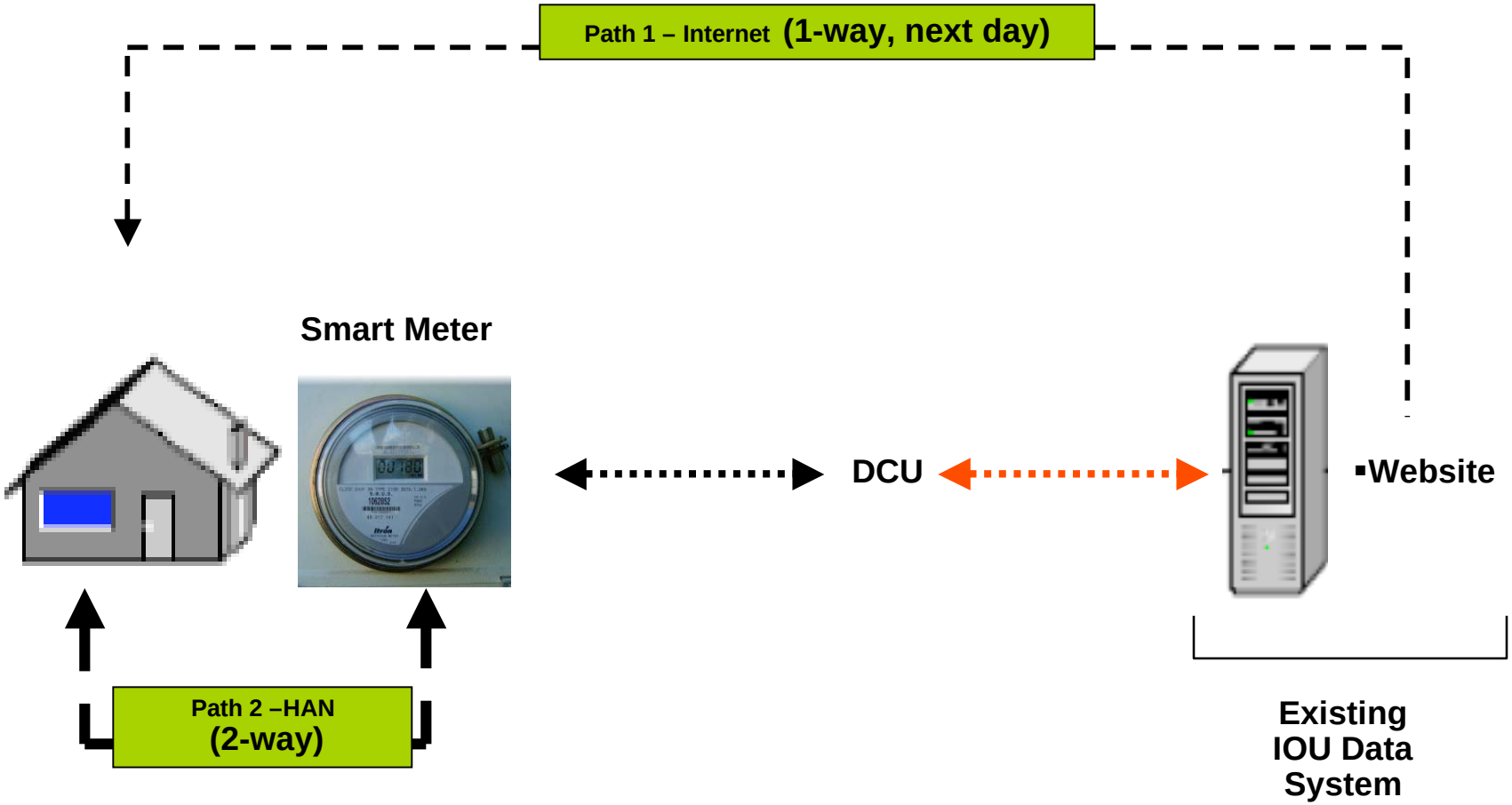
What is AMI

- Advanced Metering Infrastructure
  - Interval meters that can record usage on an hourly basis
  - Communication infrastructure that retrieve the hourly usage and send price and emergency signals to the home
  - Back-office software that processes hourly usage and bills the customer accordingly

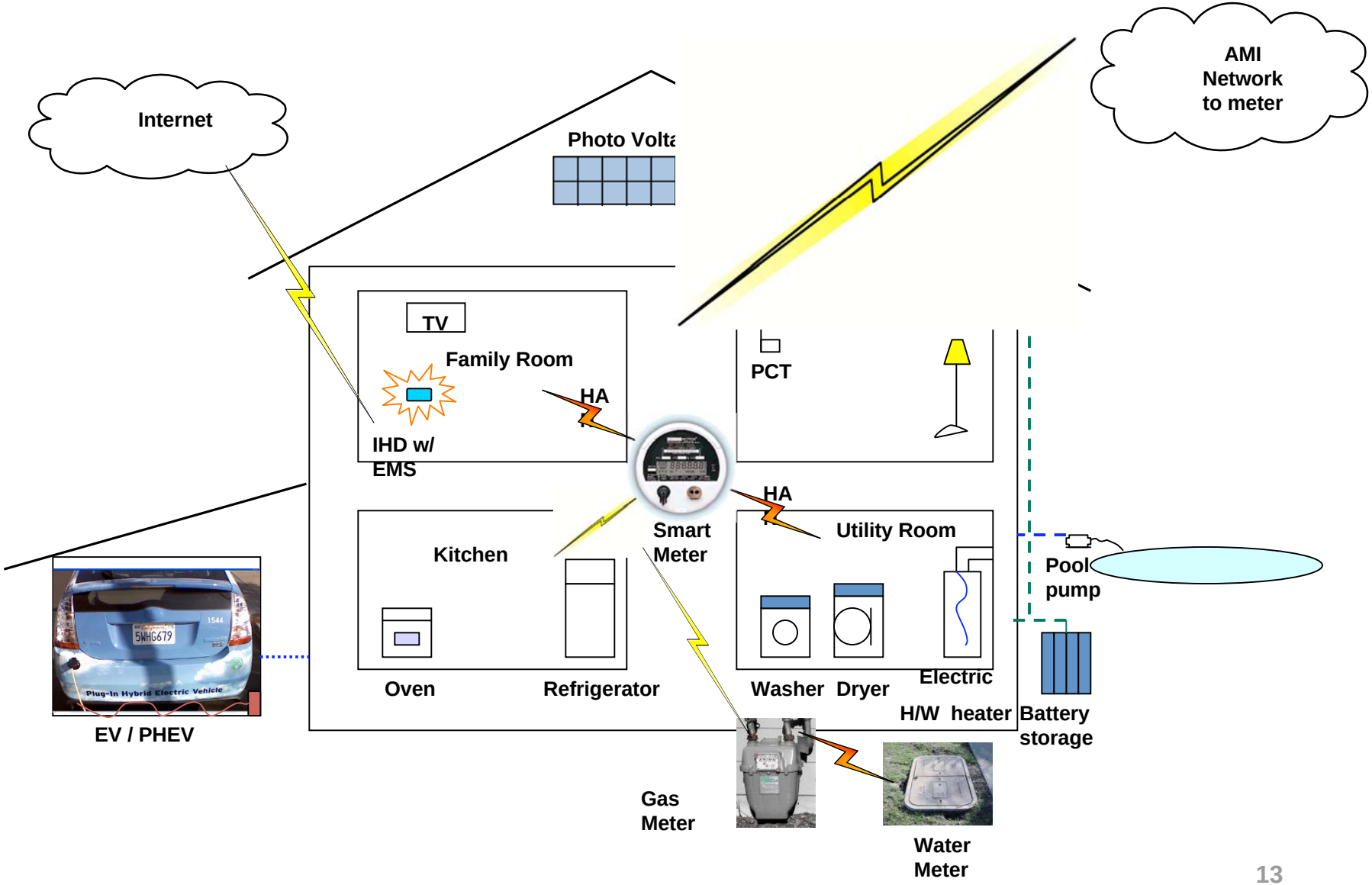
AMI provides a “Smart Meter” and two-way communication system with the utility



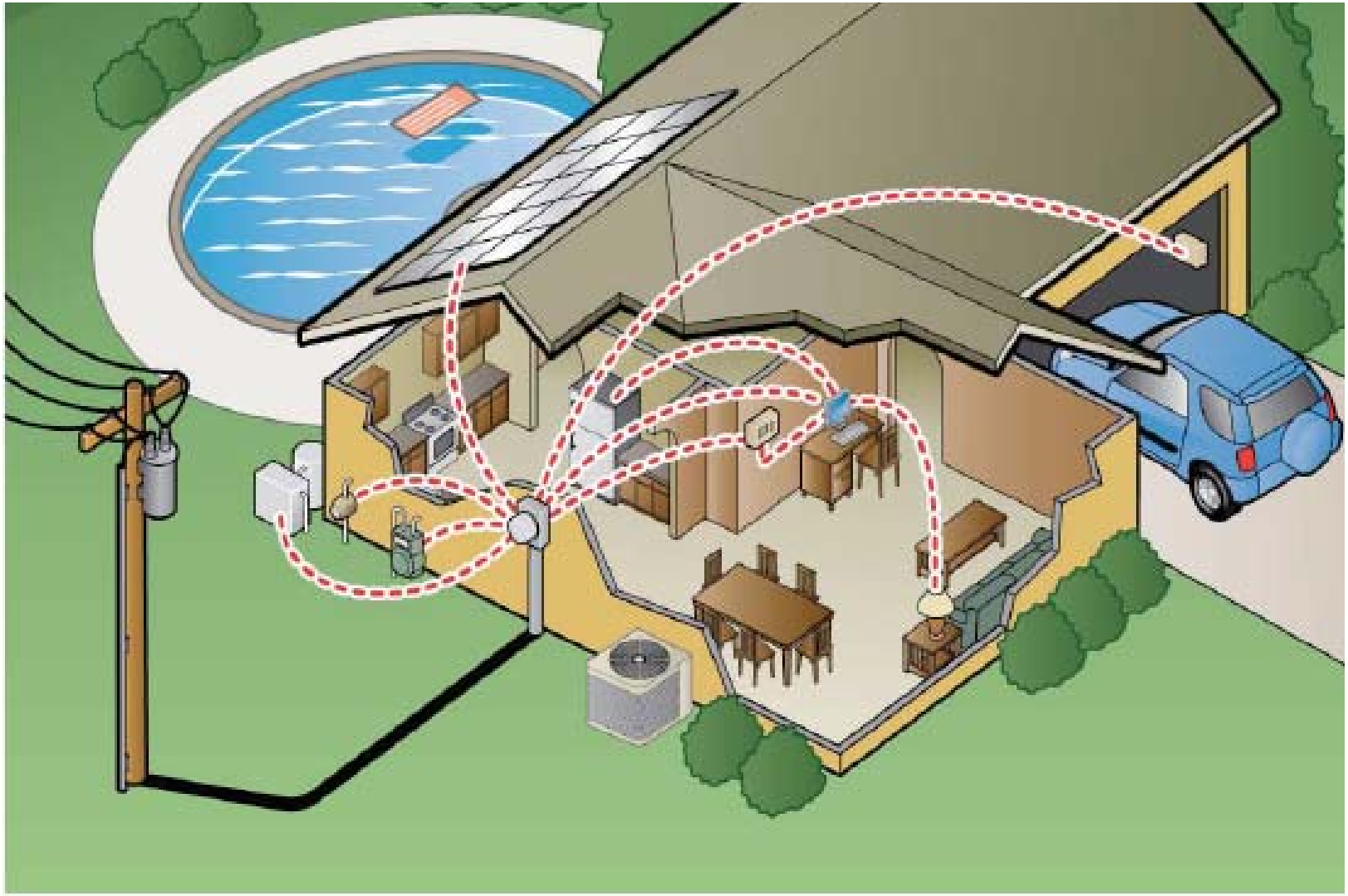
Two Methods of Providing Customer Feedback



SDG&E – Home Area Network (HAN)



SCE – Home Area Network (HAN)



Graphic provided by SCE

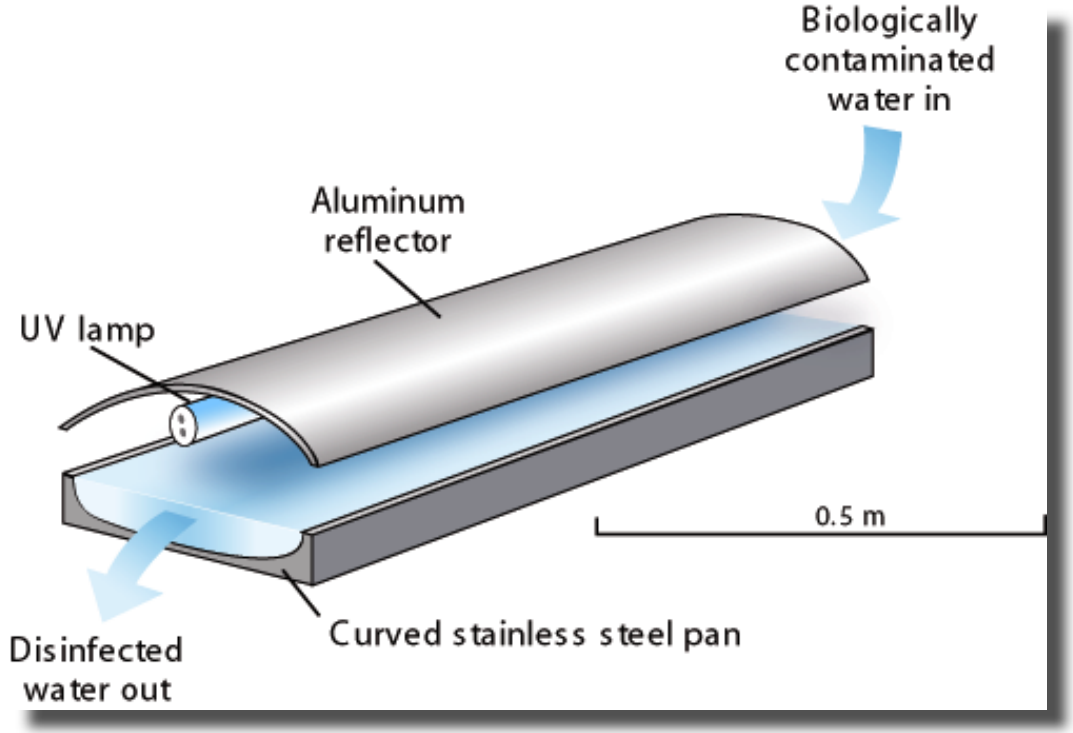
The Call to Action:
Ashok Gadgil, LBNL

Every hour 200 children, below age five, die from drinking dirty water
Every year, 60 million children reach adulthood stunted for good

Drinking Water for the Rural Poor: Boiling

- Economically unaffordable for most people, either in terms of fuel cost or fuel-collection effort
- Environmentally unsustainable
- Energy intensive: 3 kg wood needed per person per day -- (compared to 1 kg for cooking food)
- Substantial additional smoke inhalation -- cooking smoke inhalation already causes 1.6 million deaths annually. WHO (2003)

UV-Waterworks design 1993-95



- **Lamp-in-air design circumvents fouling, and avoids frequent maintenance**
- **Radiometrics ensure even distribution of dose across the channel width**
- **Hydraulics ensure narrow distribution of residence time for water parcels**
- **Channel shape compensates for light intensity drop off at edges**

A new water disinfector for the developing world's poor

Design Criteria

- Meet /exceed WHO and US EPA criteria for disinfection
- Energy efficient: 60 watts disinfects 1 ton / h
- Low cost: 4 cents disinfects a ton of water
- Reliable, Mature components
- Can treat unpressurized water
- Rapid throughput: 12 seconds
- Low maintenance: once every three months
- No overdose risk
- Failsafe

UV Waterworks Unit

Length = 28 in.

Width = 15 in.

Height = 11 in.

Weight = 15 lb.

A UVW unit with top cover off

Mohideen Jumah, Sri Lanka

Safe Drinking Water for Tsunami Survivors. Sri Lanka, 2005.

Collecting drinking water, WaterHealth Center 2006

Safe Drinking Water sells for US$ 0.002 per liter. This pays off the bank in eight years, and pays for all operations, maintenance, costs of consumables, and salaries of two part-time employees

drinking water container, WaterHealth Center subscribers 2006

One Center can serve 6000 people @ 10 L per person per day All assets belong to the village council (elected locally)

Andhra Pradesh, India, 2006

Many *poor* households purchase water delivered to their homes, at a higher price, and find it worth their while

This has spawned local entrepreneurs delivering water

Andhra Pradesh, India, 2006

Summer 2007 installation rate was two WaterHealth Centers per week. Increased to four per week by end of 2007

Andhra Pradesh, India, 2007

WaterHealth and Naandi Foundation

Naandi

WaterHealth's partnership with Naandi Foundation on community outreach and education is vital to the success of WaterHealth Centres in India

Community outreach

A long way to go, but we cracked a hard problem!

Service capacity of WaterHealth Centers in rural India
2005 --> 12,000
2006 --> 300,000
2007 --> 700,000

Rural Indian in need of safe drinking water = 600,000,000

A key point is that this is no longer charity!

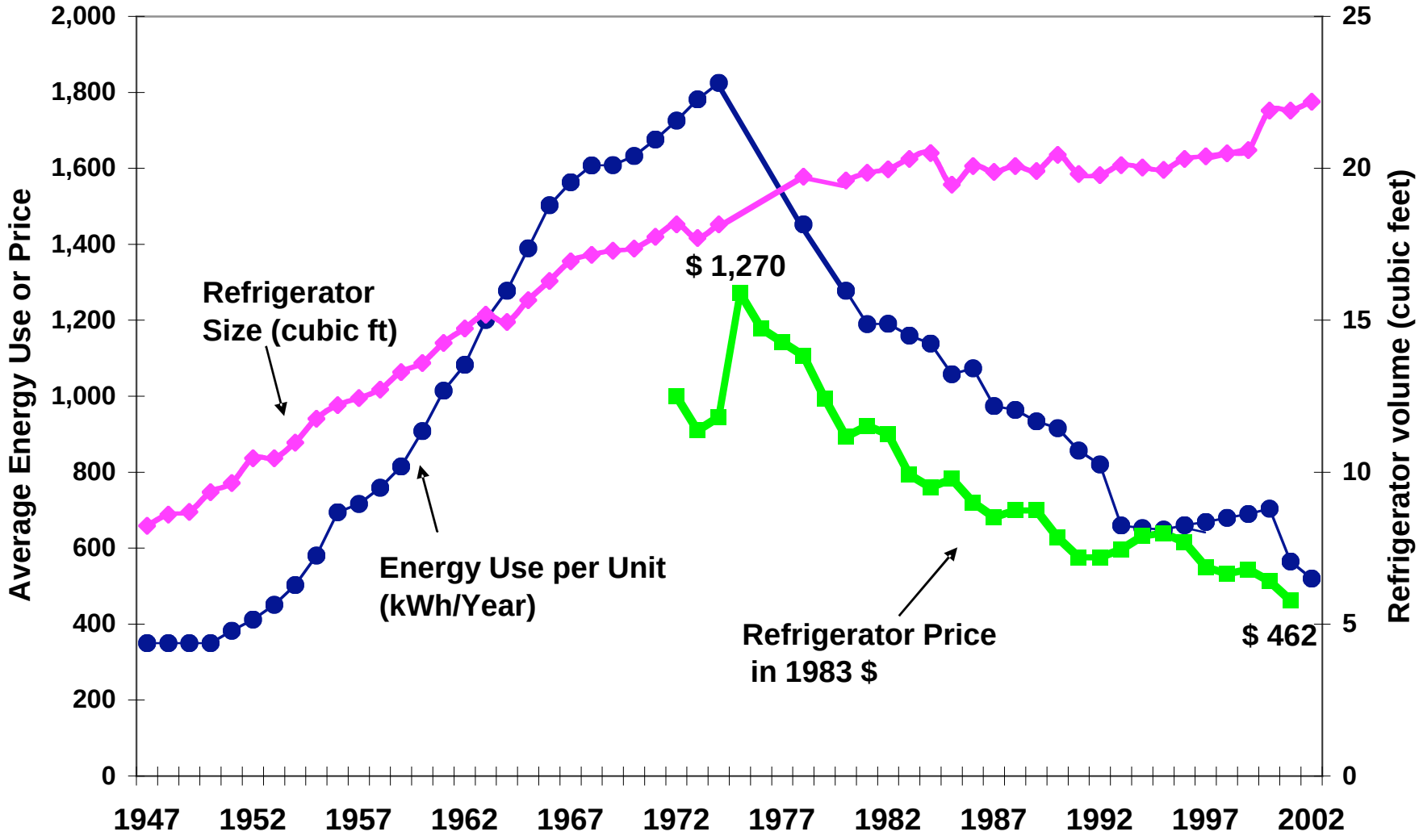
And it is affordable safe drinking water for the first time in their lives

Accelerating the installation rate

One bottleneck in ramping up installations of WaterHealth Centers is access to finance. About 70% of the first-cost of a WaterHealth Center is financed by commercial banks -- and setting up a large loan facility was becoming a bottleneck -- until now.

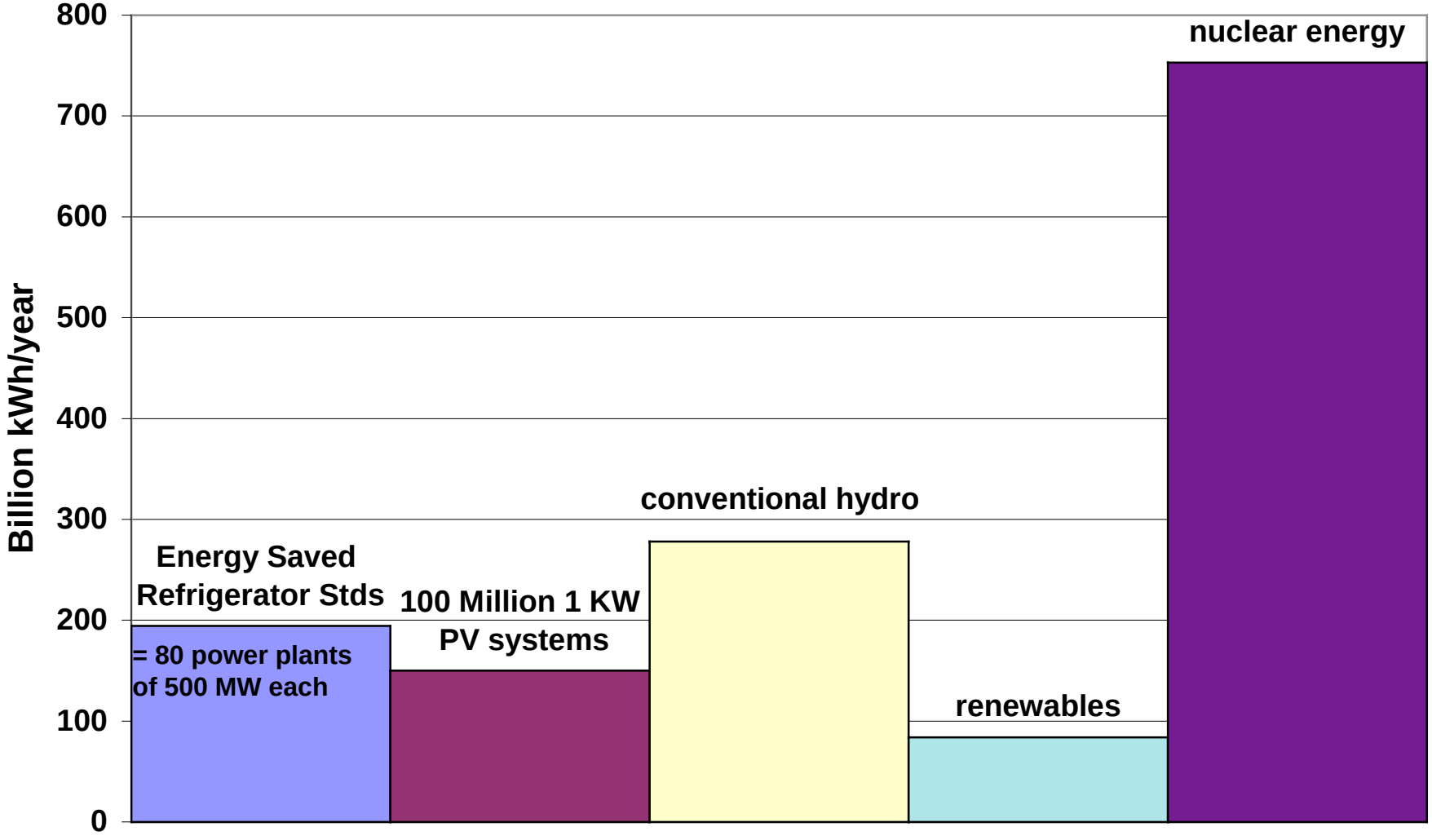
On September 28, 2007, under the Clinton Global Initiative, Dow Chemicals committed $30M in loan guarantees to WaterHealth. This will allow WaterHealth to access funds for the next 2000 WaterHealth Centers! These will serve an additional 10 million villagers

New United States Refrigerator Use v. Time and Retail Prices



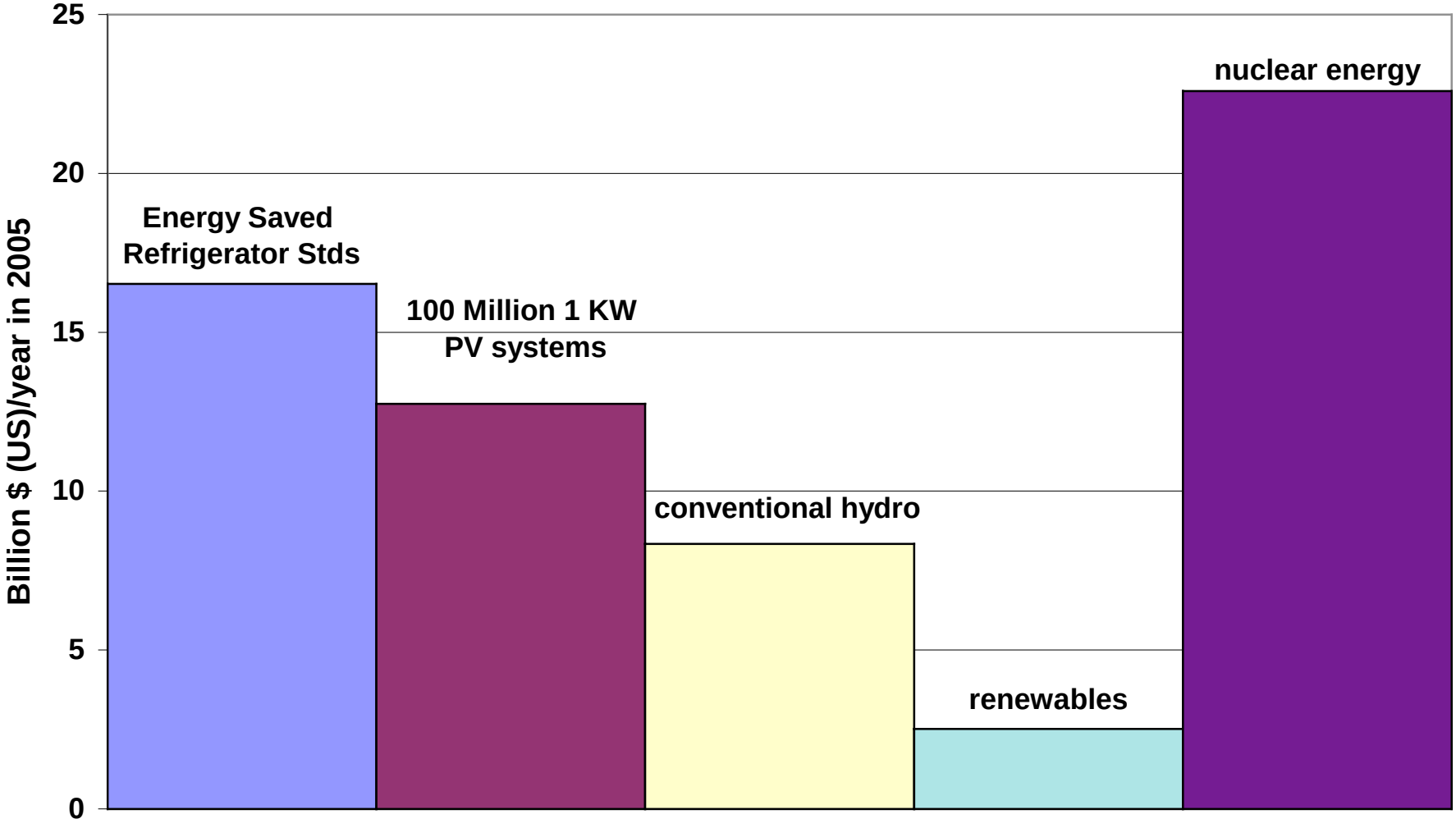
Source: David Goldstein

Annual Energy Saved vs. Several Sources of Supply In the United States



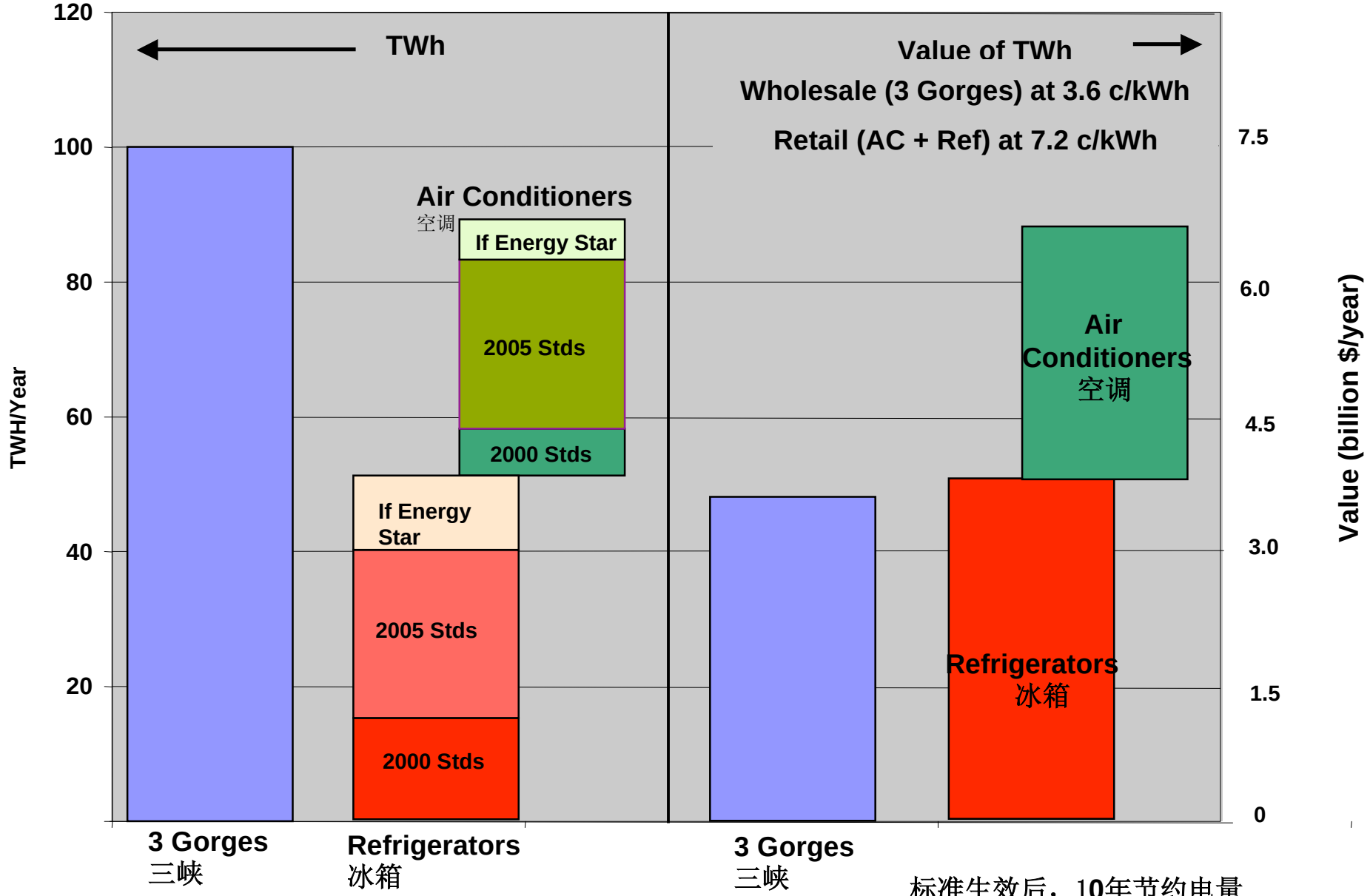
In the United States

Value of Energy to be Saved (at 8.5 cents/kWh, retail price) vs. Several Sources of Supply in 2005 (at 3 cents/kWh, wholesale price)



Comparison of 3 Gorges to Refrigerator and AC Efficiency Improvements

三峡电量与电冰箱、空调能效对比



标准生效后，10年节约电量

Savings calculated 10 years after standard takes effect. Calculations provided by David Fridley, LBNL