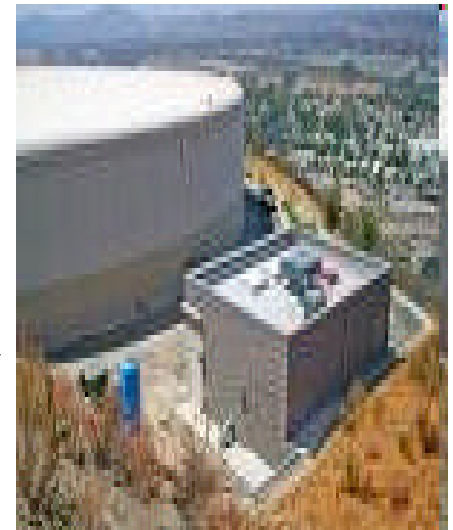


Water Storage as Energy Storage Opportunities in California



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Workshop on Energy Storage Technologies and Policies Needed
to Support California's Renewable Portfolio Standard (RPS) Goals of 2020

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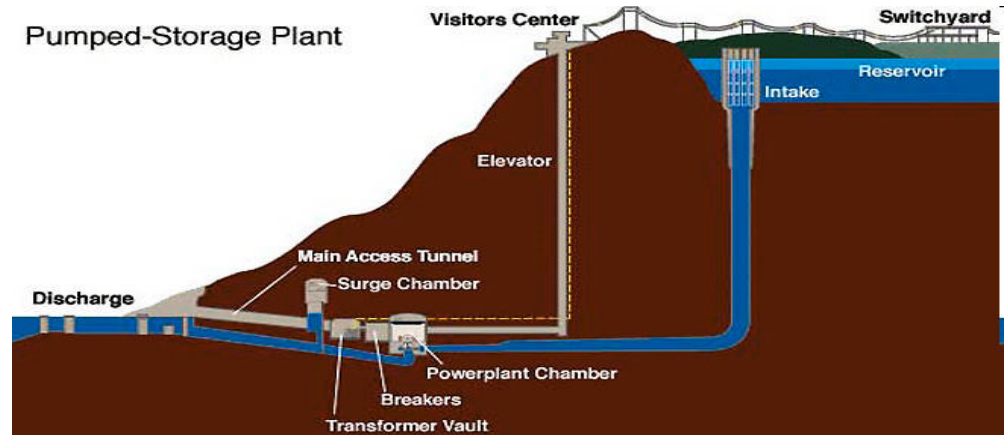
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Subject of this Testimony



- Water stored at elevation is stored energy.
- There are large water pumped storage facilities in operation within water agencies (e.g., San Diego County Water Authority) and others being planned (e.g., Lake Elsinore, Olivenhain)
- Testimony today is not about those, but about smaller (<10 MW each) opportunities available in most water districts

Water Agency Storage



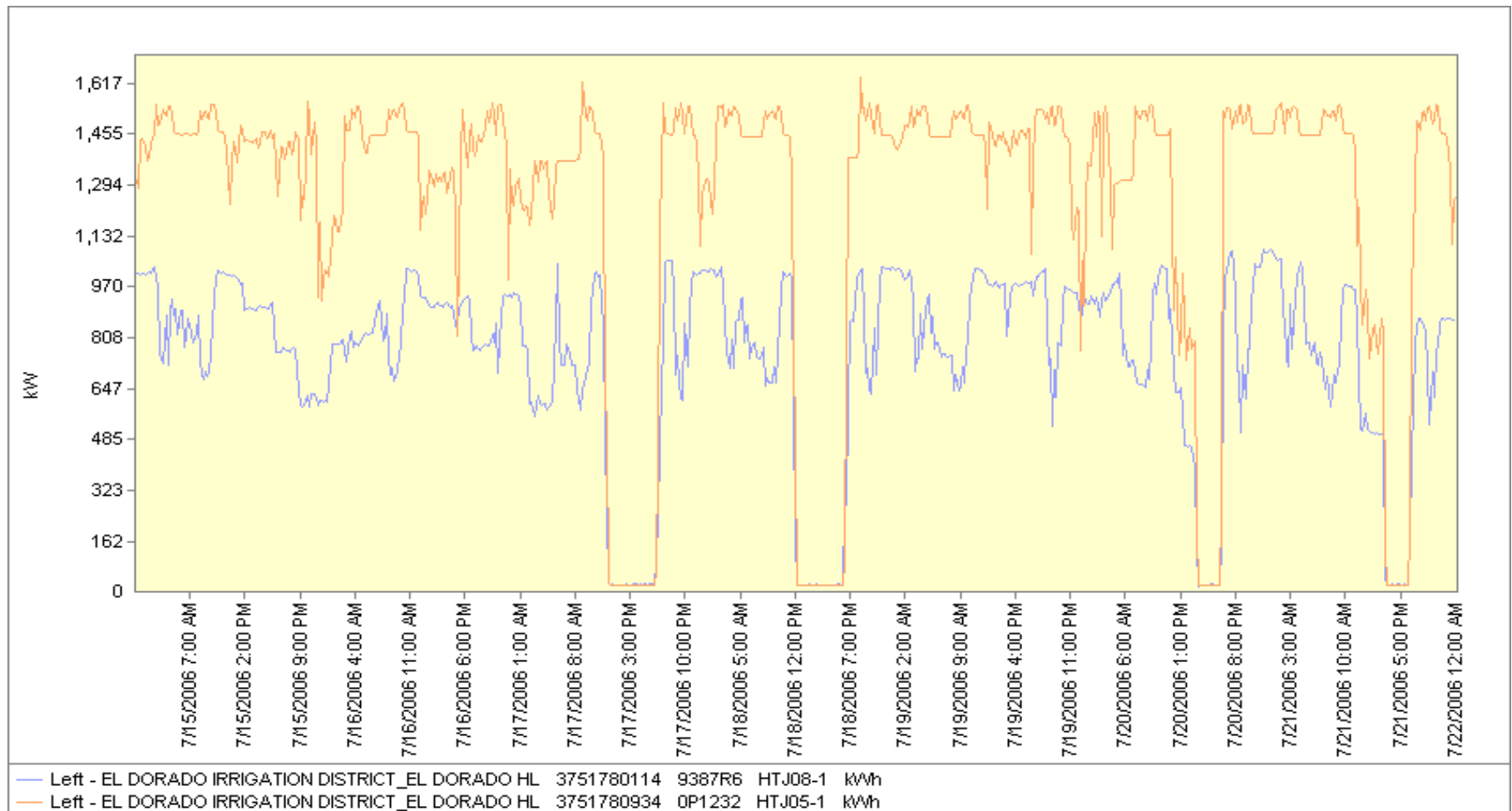
- All water agencies that supply treated water have some storage
- Storage added to optimize water system - not for electrical generation or demand reduction
- Water storage is at elevation if possible - provides pressure to system
- Existing storage is used to meet bimodal daily peak water deliveries and smooth out treatment plant production
- However, it can be used to “store” energy by using energy to fill storage, or releasing energy when storage drained

Examples of Types of Water Storage Opportunities

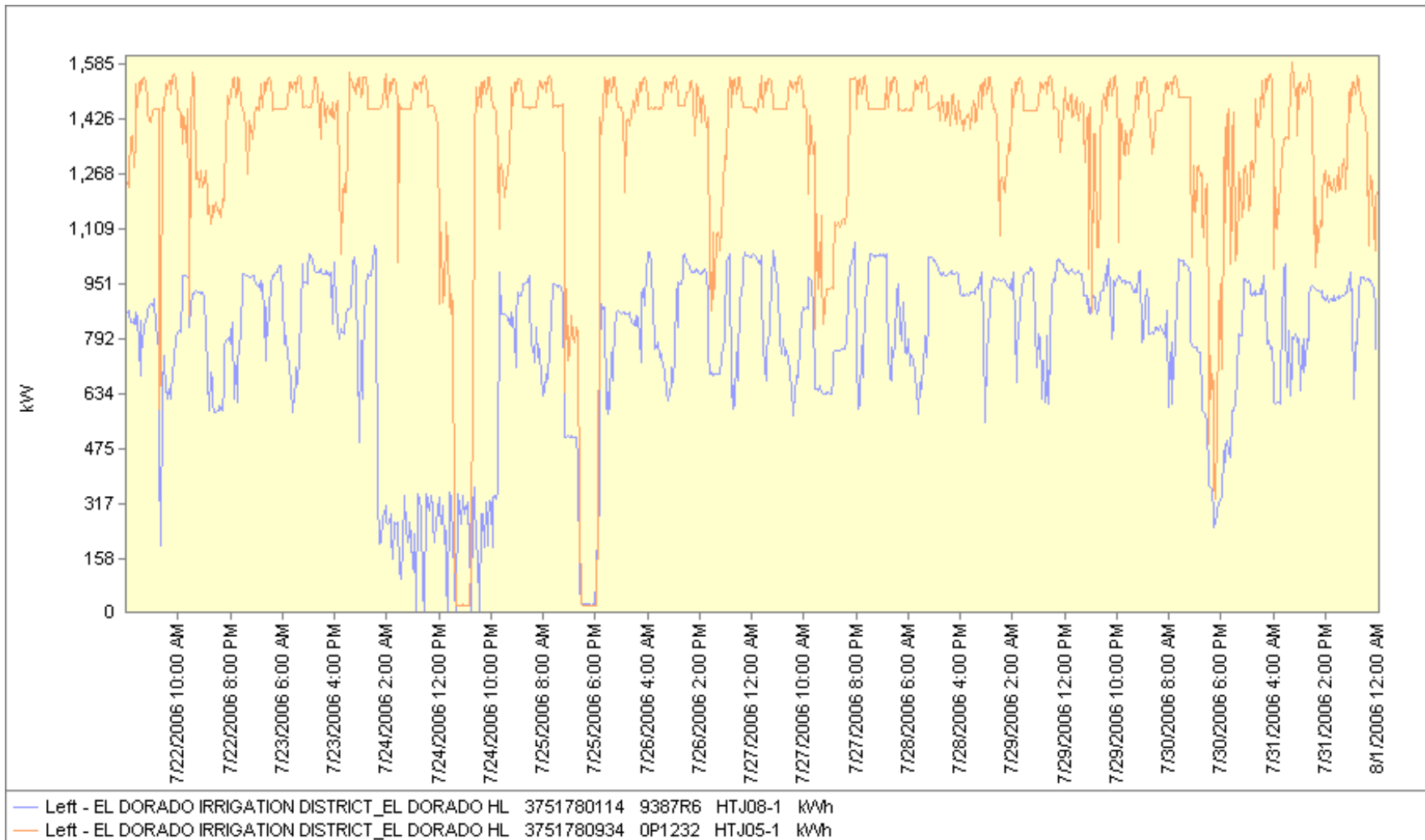


- Water storage with hydroelectric generation
- e.g., Calleguas MWD
- Water storage with treatment plant and pumps - e.g., El Dorado
- Groundwater storage can work very similarly - e.g., Semitropic, Arvin Edison

EID El Dorado Hills Raw Water and Treatment Plant - July 15-21, 2006



EID El Dorado Hills Raw Water and Treatment Plant - July 22-31, 2006



Potential for Smaller Water Storage as Energy Storage



- Currently approximately 400 MW of electric load is dropped during on-peak period by water agencies in the state
- Existing facilities reoperation
 - + 250 MW
 - vagaries/instability of demand response programs have not encouraged reoperation of water storage facilities
- New storage facilities and retrofit of existing facilities with reversible pump turbines
 - +500 to 750 MW
 - economics uncertain. no long term contracts for recovery of investment
 - integration with current water system operation needs to be evaluated

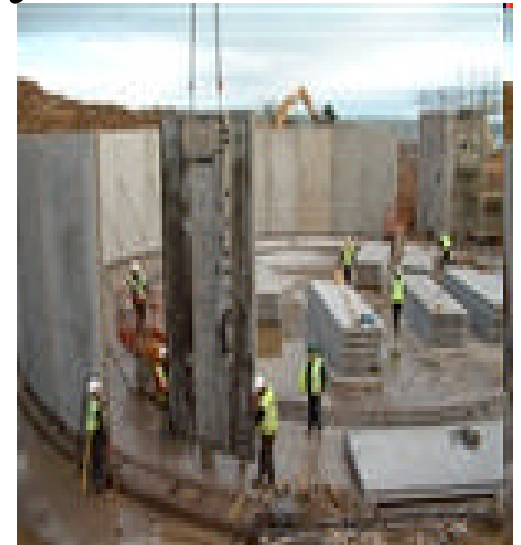
Water Storage as Energy Storage Facilities



- Advantages
 - Proven technology
 - Less expensive than other storage technologies
 - Easy to site - multiple locations already reserved for additional water storage
 - Locations close to load centers
 - Provides dual advantages - improves water and energy infrastructure efficiency
- Disadvantages
 - Smaller size (2-10 MW typical)
 - Existing storage integral to water system operations, will need modified operation protocols
 - Current economics discouraging - no long term contracts for recovery of investment available

Additional Information Needed

- Water storage response to ISO needs
- How quickly can water storage respond
 - shift from pumping to draining/generating
- What water agency operational protocols need to be changed and how
- Economics of operation for energy rather than for water use
- Economics of new construction
 - reversible pump/turbines replacement of current pumps
 - construction of new storage tanks



Conclusions



- Exotic energy storage technologies are nice, but don't ignore simple, readily available existing technology
- Water agencies storage opportunities could add 1,000 MW of additional energy storage
 - Proven technology, least expensive storage option, locations readily available, improve water as well as energy infrastructure
- Needed -
 - information on water system operation changes necessary for use as energy storage facility
 - economics of replacing pumps with reversible pump turbines
 - economics of new storage construction for energy use