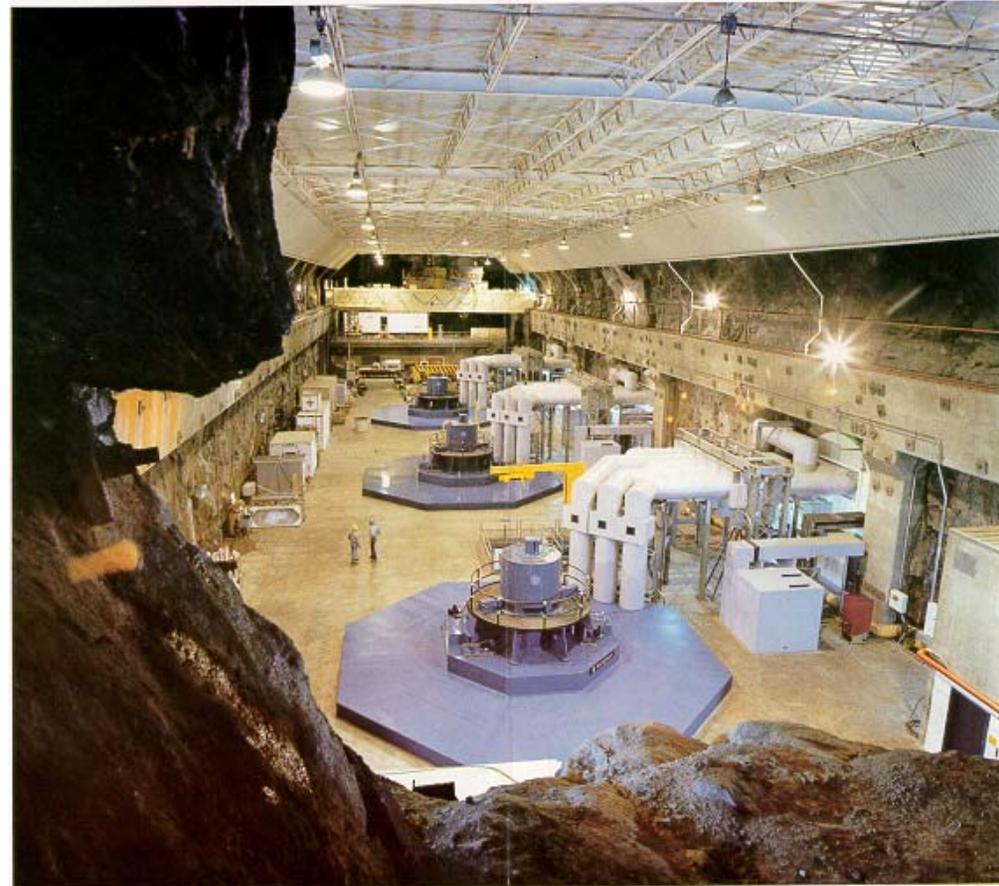

Helms Pumped Storage Plant

Northwest Wind Integration Forum
Workshop

Manho Yeung

Pacific Gas and Electric Company

October 17, 2008



Pacific Gas and Electric Company - Overview

Headquarters Location

San Francisco, CA

Service Area

70,000 square miles in northern and central California

Service Area Population

15 million people (or about 1 of every 20 Americans)

Distribution Customer Accounts

5.1 million electric, 4.3 million gas

Employees

Approximately 20,000

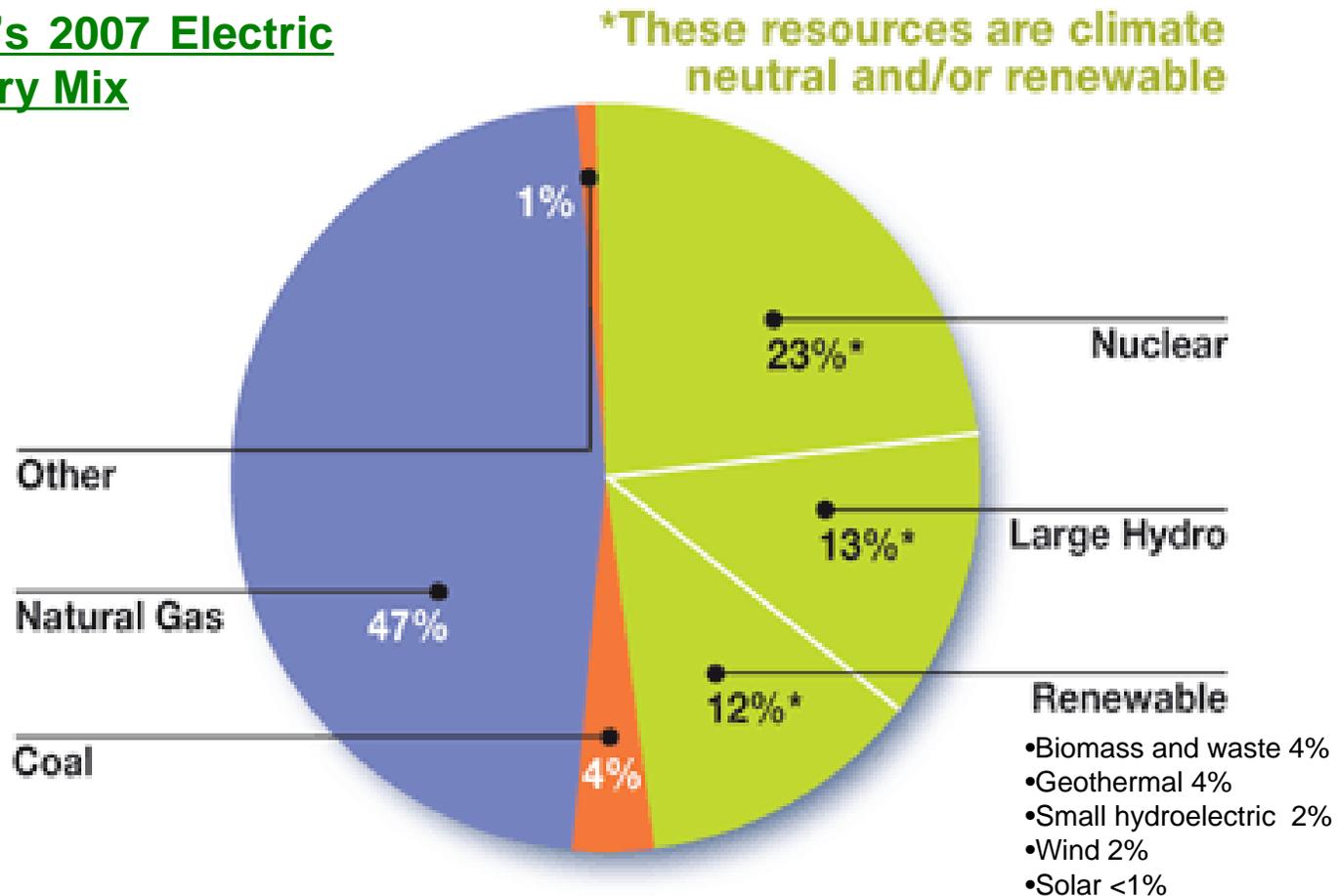
System

- 159,364 miles of electric transmission and distribution lines
- 48,198 miles of natural gas T&D pipelines
- 6,271 megawatts of generation, including
Diablo Canyon nuclear power plant,
Helms pumped storage plant, and
one of the largest hydroelectric systems in the country



On average, More than 50% of PG&E's Portfolio is Carbon-Free

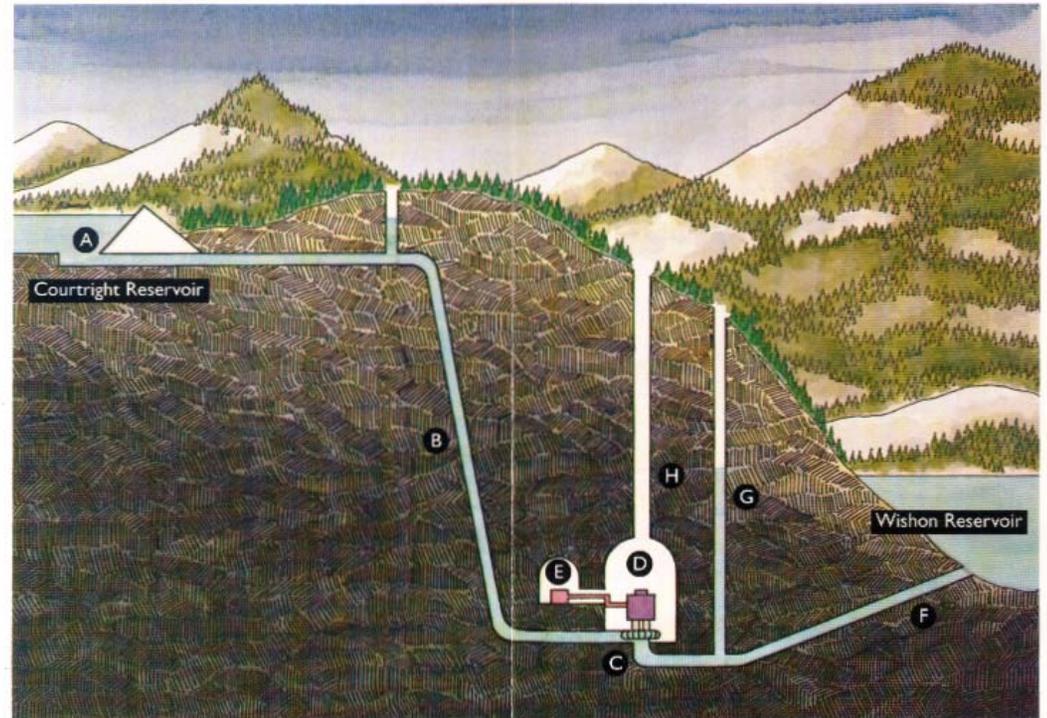
PG&E's 2007 Electric Delivery Mix



Note: Delivery mix includes all of PG&E's owned generation plus all of PG&E's power purchases. PG&E's direct purchases of coal have not increased and remain at 1.6%. The higher number on the chart is due to state regulations that assume a higher mix of coal in market purchases. Also, 2007 was a below normal hydro year.

Helms Pumped Storage Plant is in its 25th Operating Year

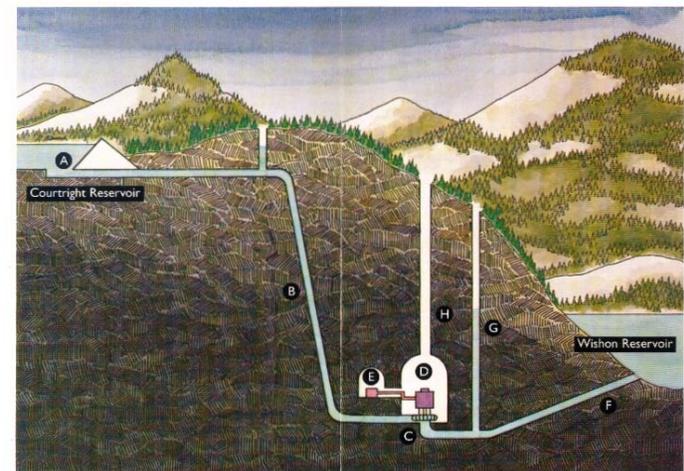
Location	Central California, about 50 miles east of the City of Fresno
Commission	June 30, 1984
Upper Reservoir	Courtright Lake 123,000 Acre Feet
Lower Reservoir	Lake Wishon 129,000 Acre Feet
Installed Capacity	Three units; 1,212 MW generating; 930 MW pumping
Average Energy	<100 GWh per year (natural in-flow)



A-Courtright, B-Supply Tunnel, C-Turbine, D-Generator, E-Transformer, F-Wishon, G-Surge Chamber, H-Elevator

Helms Generates During Day Time and Pumps at Night

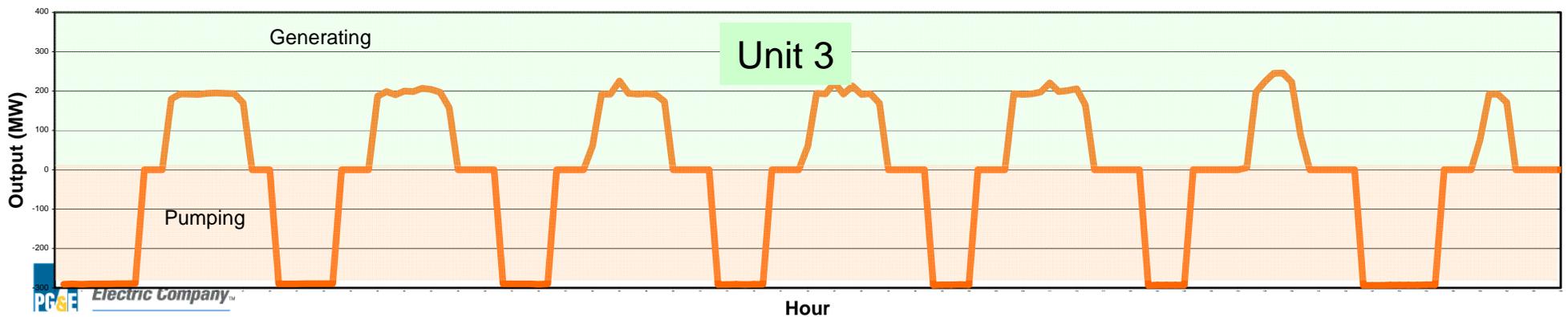
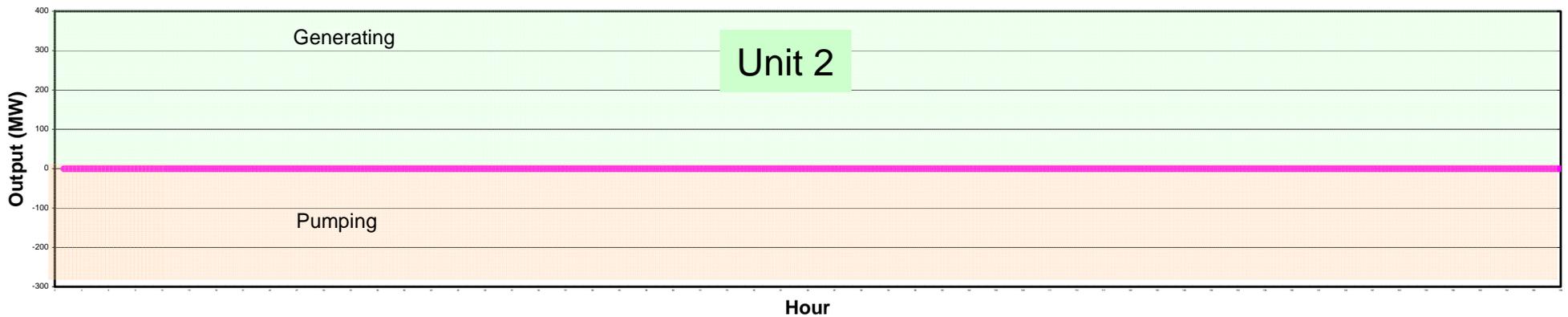
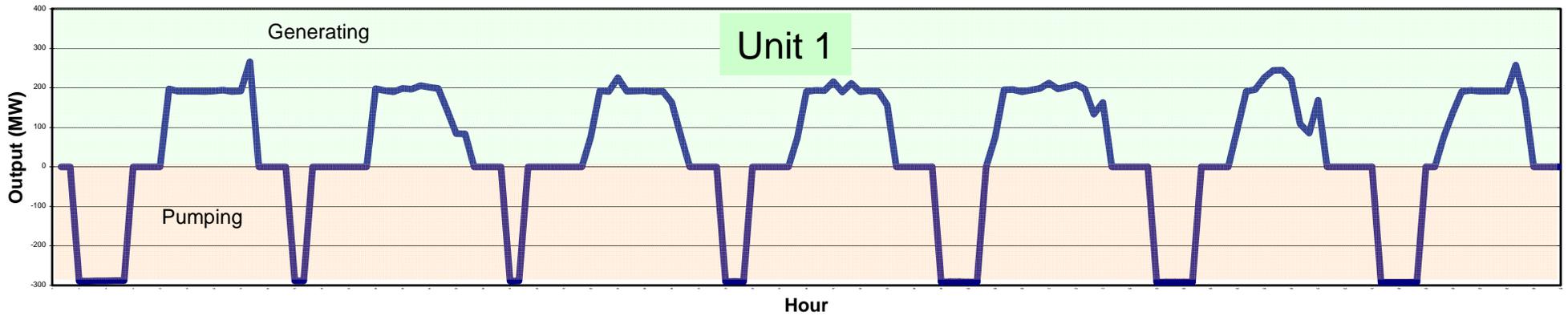
- Helms has three identical reversible pump-turbine motor-generator units
- 1,212 MW total in generation mode, and 930 MW total in pump mode
- Units are housed in a chamber about 1,000 feet underground
- In generating mode, water would
 - release from Courtright Lake
 - travel at 9,000 cubic feet per second
 - through a 22,000 feet long supply tunnel, and
 - drop 1,744 vertical feet before discharging into Lake Wishon
- In pumping mode, the units would reverse and pump water from Lake Wishon into storage at Courtright Lake
- Units have fast operating capability:
 - Dead stop to full generation in eight minutes
 - Dead stop to full pump in twenty minutes (single speed)
 - Generating ramp rate of 80 MW per minute per unit



Helms Provides PG&E Customers with Many Benefits

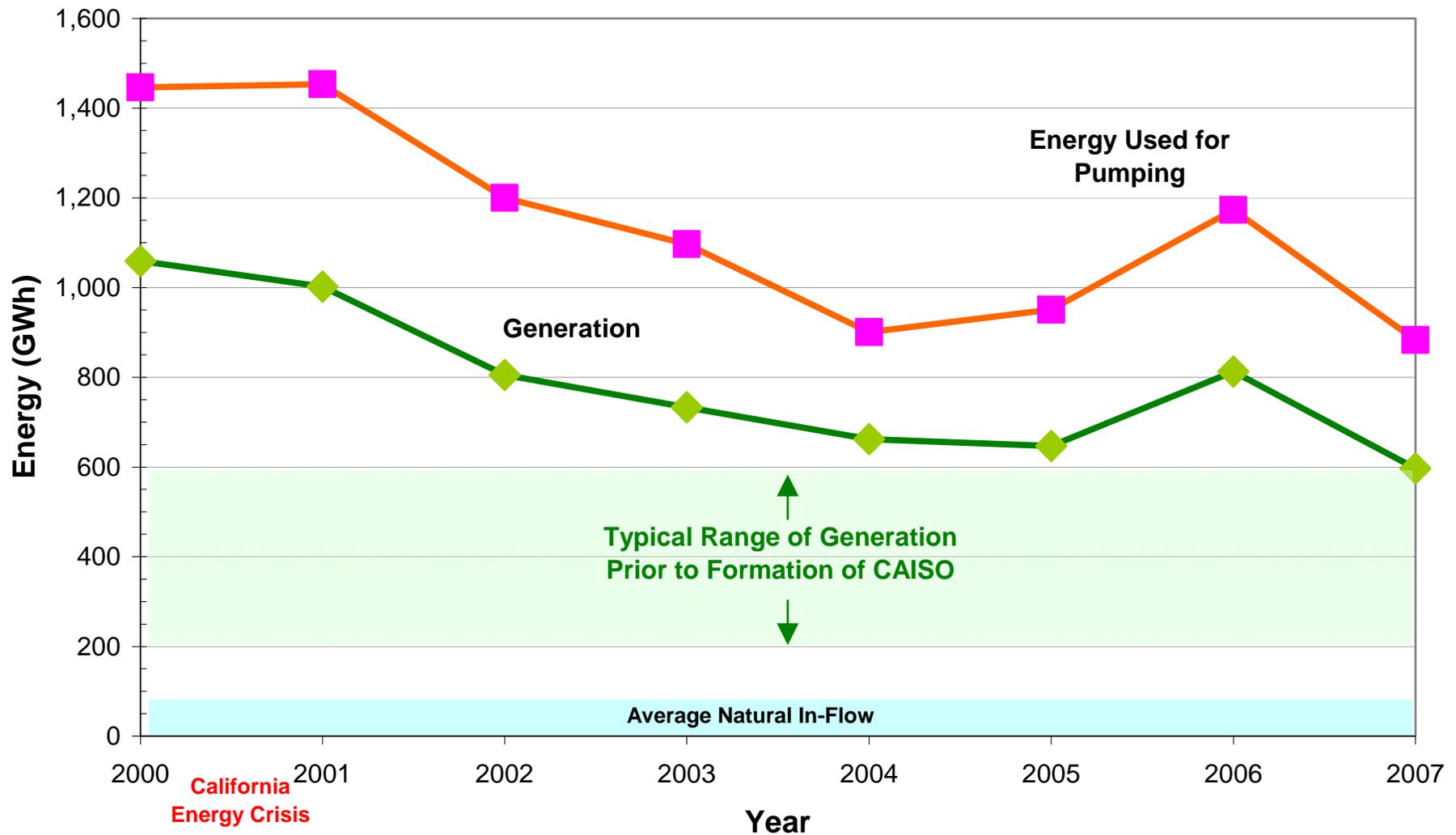
- Storage of economy energy, or surplus or lower cost energy that is sometimes available at night for daily cycling or during Spring runoff conditions for seasonal storage
- A large amount of fast acting spinning reserve and regulation capability, or generating capacity that is immediately available to meet fluctuations in electric demand
- Revenues from CAISO's energy and ancillary markets (regulation, spin and non-spin)
- Helps alleviate over-generation or minimum load condition by using excess energy to pump water into storage
- Allows operation of thermal plants at a more steady output level, resulting in higher efficiencies
- Reduces dependence on fossil fuels and greenhouse gas emissions (environmental benefits)

Helms Operation – Typical Summer Week



Helms' Production Substantially Exceeds its Natural Inflow

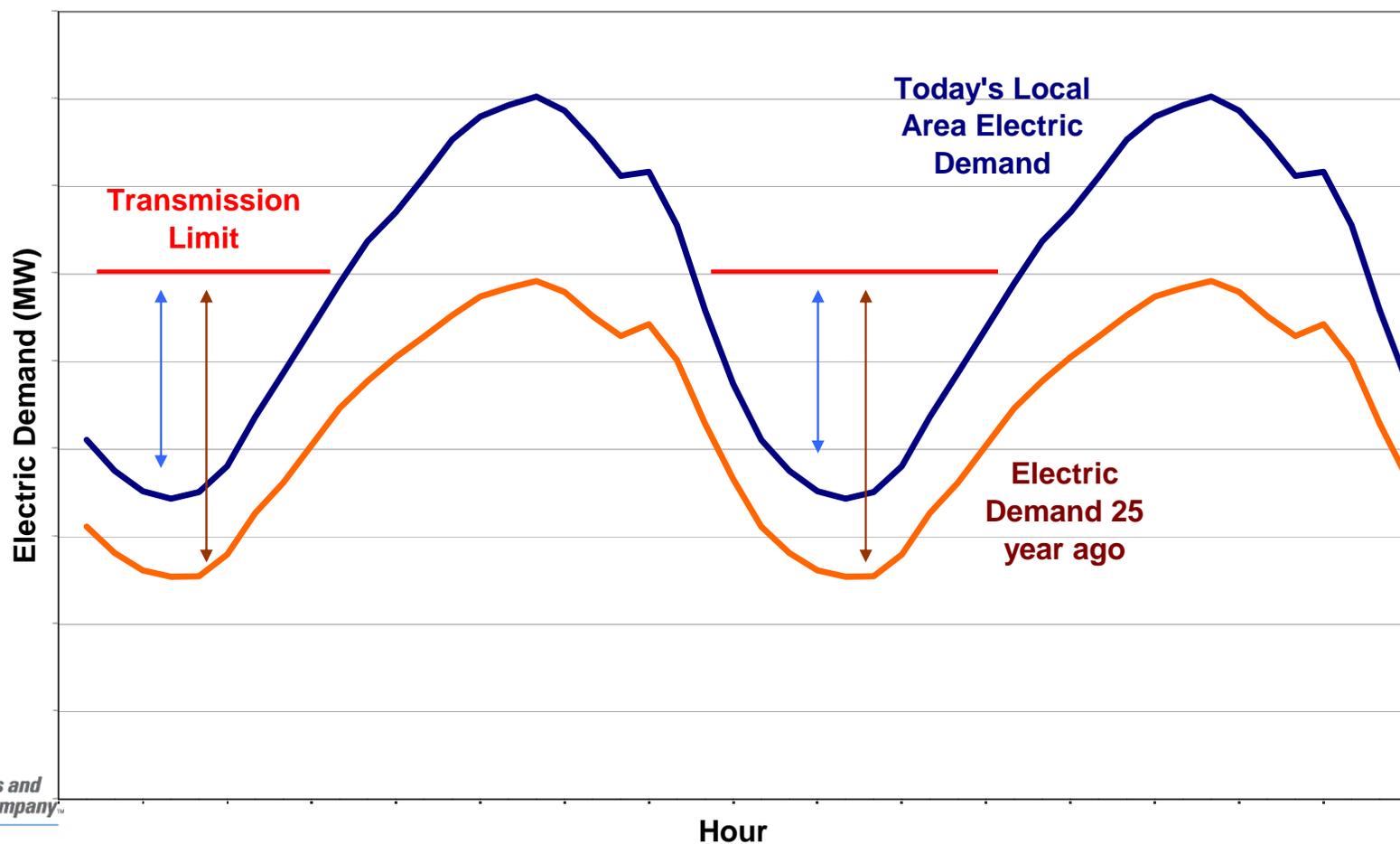
Helms Pumped Storage Plant
Historical Annual Generation and Pumping



Demand Increase has Consumed Transmission for Pumping

- Over the past 25 years, electric demand in central California has increased and has consumed some transmission capacity for pumping at Helms during off-peak hours
- PG&E has plan to construct a new 150 mile long 500 kV transmission line to, among other things, restore Helms' pumping flexibility

Illustrative Demand vs. Transmission Capability for Pumping



Future Changes to Helms PSP Operation --- Unclear

Potential drivers are:

- Electric transmission constraints
- Intermittent renewable generation
- CAISO's Market Redesign and Technology Upgrade initiative and its Nodal and Locational Marginal Pricing
- Western Electricity Coordination Council's draft Frequency Response Reserve criteria in addition to the current spinning reserve requirement

PG&E is Evaluating New Pumped Storage Opportunities

- More pumped storage plants is good for power system operation
- In 2008, PG&E has sought and received FERC permits to evaluate potential pumped storage hydro facilities at Mokelumne River and Kings River
- PG&E is currently evaluating several potential pumped storage sites based on using a number of existing or new reservoirs

In Summary

- PG&E's Helms Pumped Storage Plant has provided positive economic, reliability, operational and environmental values to PG&E's customers for almost 25 years, with many more to come
 - Helms can facilitate storage of economy energy on both a daily and a seasonal basis
 - Helms is an effective means to resolve over-generation and minimum load issues
 - Helms, with its fast operating characteristics, is a valuable tool for system operators to meet changing demand and system conditions
 - Helms is very valuable in the ancillary market as well as the energy market
 - Helms can also be an effective tool to accommodate and integrate intermittent renewable resources
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QUESTIONS???