Brian Browne
Presentation 3/27/08

- Water supply availability
- System Reliability
- Demand forecasting

Actually - Focus on Hetch Hetchy's supplies from current pristine sources. System reliability is defined as a function of system integrity and hydrologic conditions (usually based on long-term historical data). System integrity is a function of the stability of the existing structure and type and timing of the ongoing capital improvement and R&R programs (CIP/WSIP) being implemented.

Demand forecasting using a combination of economic theory, mathematics, and statistics AKA econometrics. Subsumes quantity demand responses to changing prices (elasticities), etc. This approach is different from end-use forecasting in that price has a more determining role in allocating available resources.

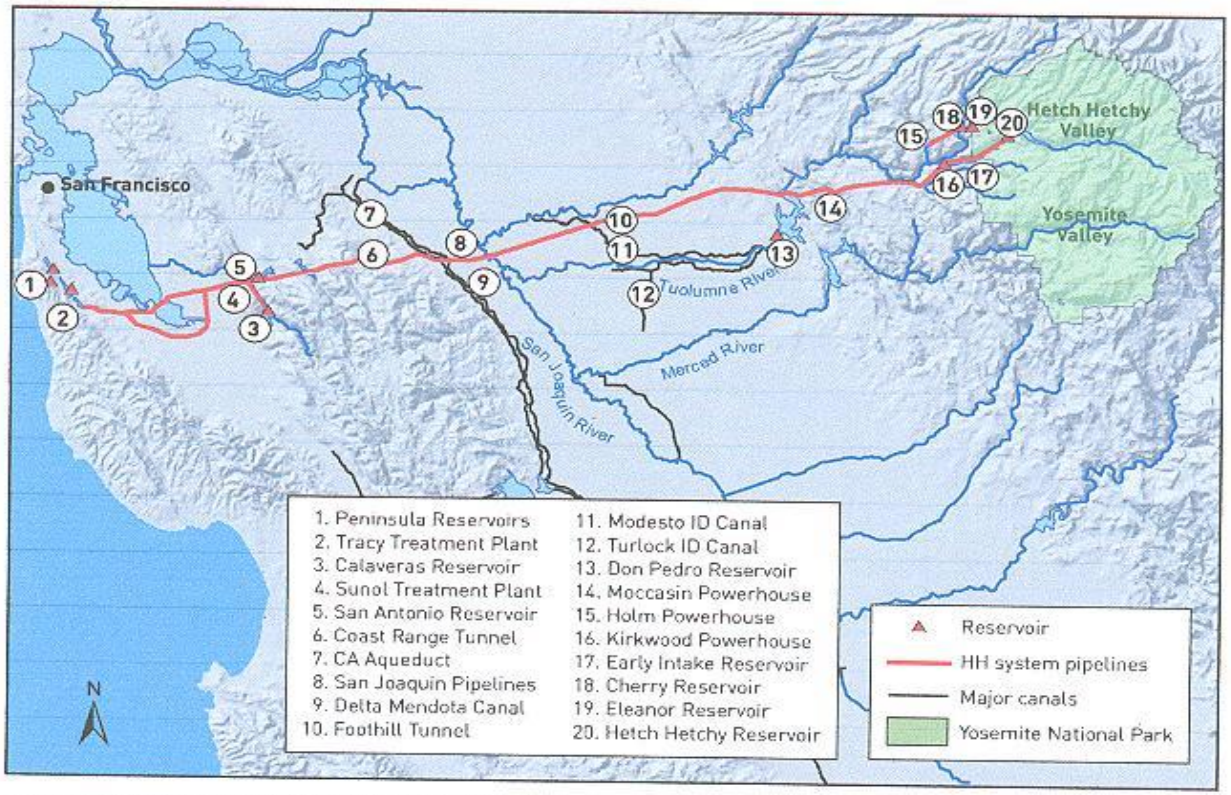
This is a work-in-progress

Why in a few words?

- Overestimating supply availability from current pristine sources could lead to problems such as having to rethink the current “pre-negotiating principle” that the 1984 MWSA commitment to BAWSCA of 184 MGD must be back on the negotiating table for 2009 and not an immovable feast day. 184 MGD to BAWSCA does not appear feasible.
- It appears that San Francisco must adopt a meet San Francisco's water requirements first then on a “best effort” basis provide the remaining excess supplies to the peninsula.
- Water availability is the denominator in estimating $/unit water. If the denominator is less that projected the quotient, albeit water rates will be higher. AKA rate shock.
- Expanding the HH system to use other source supplies will increase the cost function and lower the quality index.
- State law mandates that water must be available to proceed with urban developments. This has become a big factor in S. Calif. Development constraints. We will not remain immune to this state mandated constraint in N. Calif.
- Price. The first law of demand – an increase in price will lead to a decrease in units consumed. The longer this price remains the greater this decrease in units consumed. If a 1 percent increase in rates leads to a greater than 1 percent decrease in units taken then total revenues will decrease. This will have many impacts, especially on the ability of the SFOUC to retire revenue bond debt from rate increases.

The Hetch Hetchy System

Overview of SFPUC water system and other Tuolumne River facilities



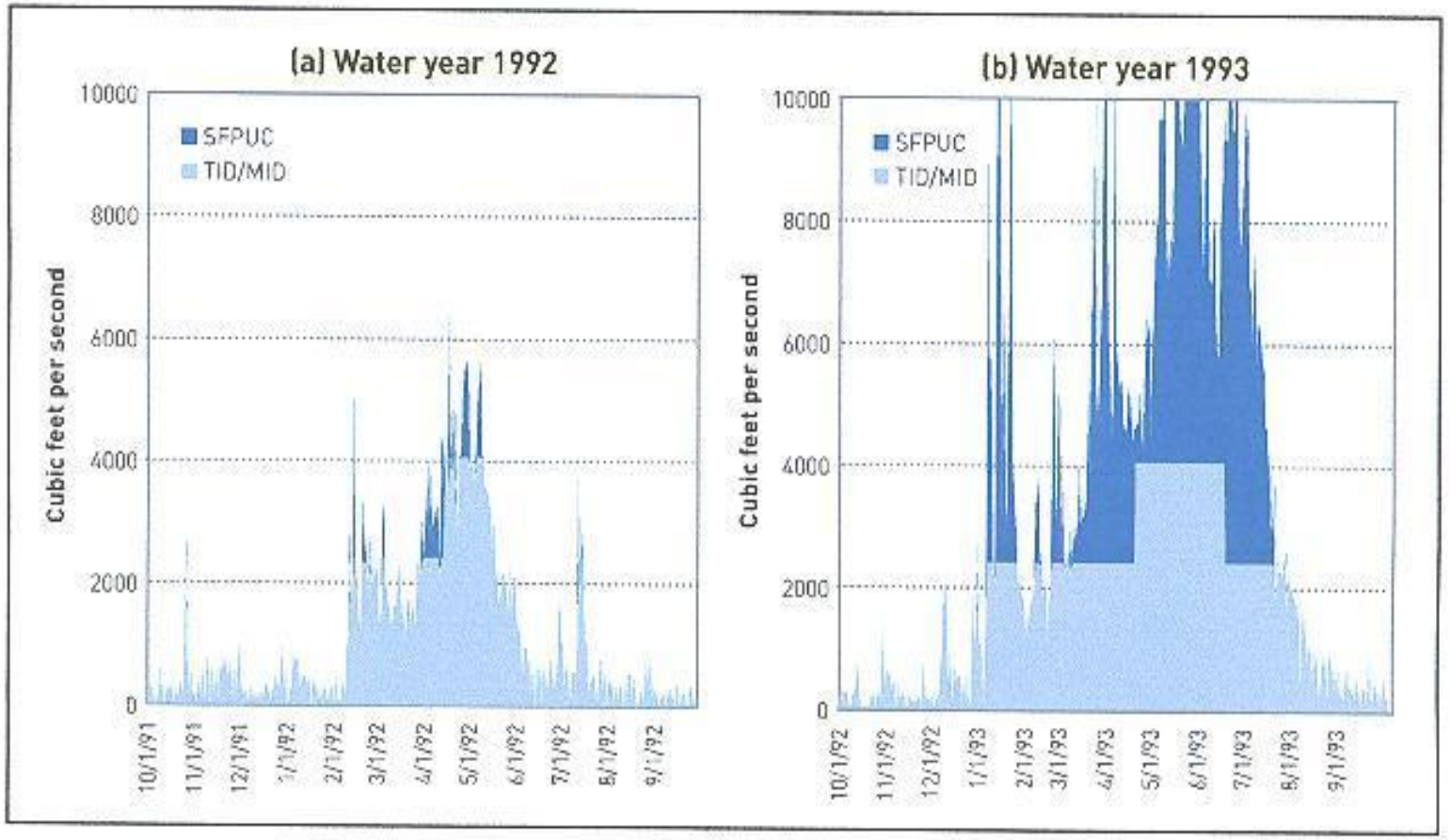
Hetch Hetchy Reservoir is part of an extensive system that includes several reservoirs, water treatment plants, hydropower facilities and a 160-mile series of pipelines and tunnels that carries Tuolumne River water from the Sierra Nevada to the Bay Area. Hetch Hetchy Reservoir holds less than 25% of the system's total storage capacity.

The rate of the flow in streams and rivers is typically measured in **cubic feet per second (cfs).** One cubic foot is about 7.5 gallons; one cfs is equivalent to 724 acre-feet per year.

Tuolumne River (TR)

- One of the largest rivers in California's Sierra-Nevada Mountains. Well farmed with many uses. It has been described as a hard-working river
- Hydrology
- Average annual flows of 1.8 million acre-feet (1,607 MGD). On average every 4th year 1.1 million acre-feet. (982 MGD).
- Approximately 60% of Tuolumne River flows occur between April and June
- Three droughts over hydrologic period period 1922-1994: 1928-34, 1976-78, and 1987- 1992. In 1977 SFPUC extracted 3 MGD from TR and in 1992 61 MGD.
- 2000 – BAWSCA (BAWUA) and SFPUC estimated system reliability at 240 MGD based on system integrity and hydrologic history 1929-1999.
- Water Rights
- Bay Area and SFPUC threshold 2,416 cfs at La Grange, except mid-April to mid June TR flows must exceed 4,066 cfs. Irrigation districts have “senior” riparian rights get base flows. SFPUC has “junior” water rights.
- Global warming? Earlier takes?

Tuolumne River water rights distribution
SFPUC – extractions drought year (1992) and non-drought year (1993)
y = cubic feet per second x = 10/1-9/1

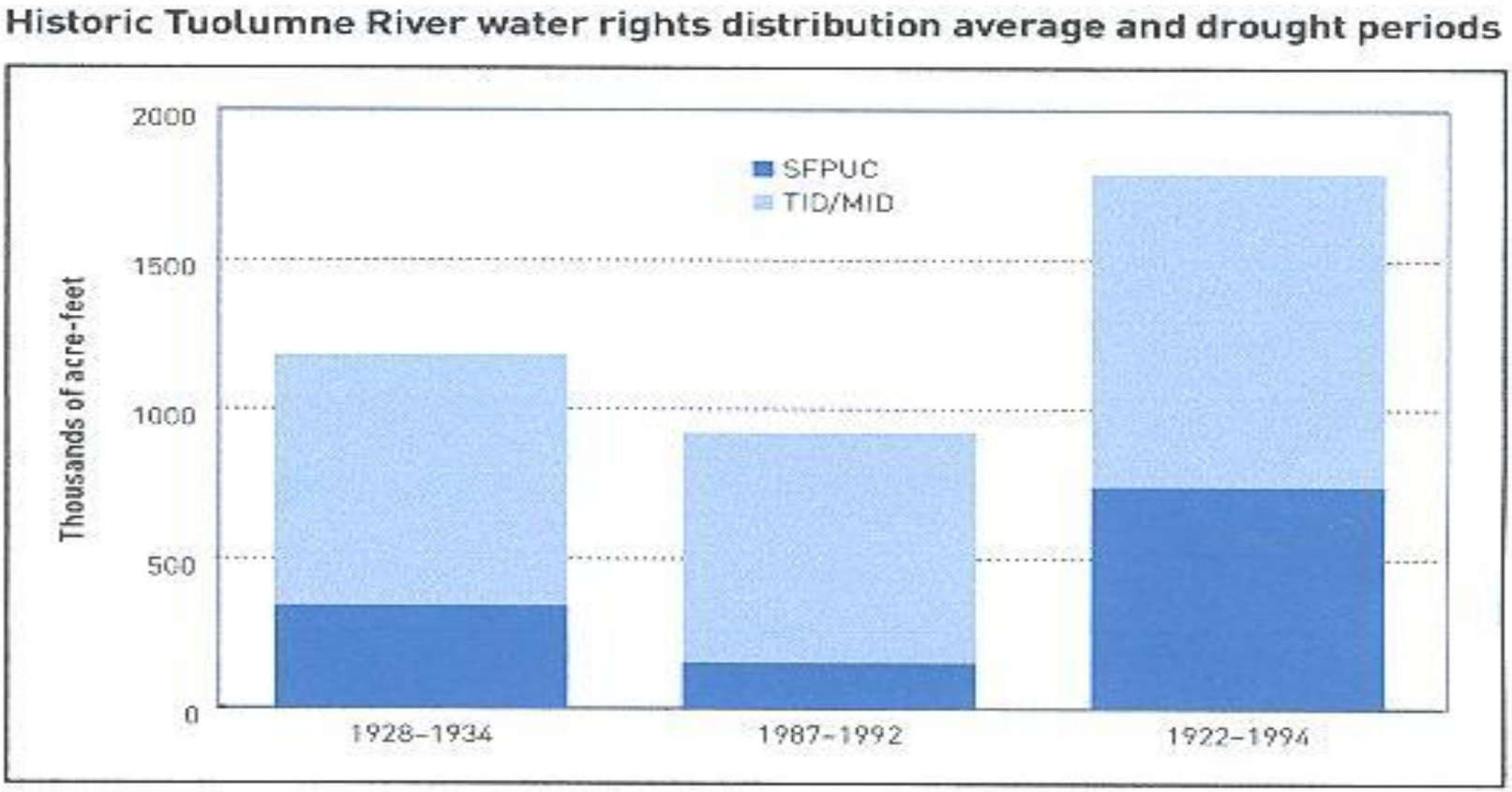


For Bay Area water users, the extremes of the Tuolumne's natural hydrology are exacerbated by the SFPUC's "junior" water rights. 1992 was not only a dry year, it marked the sixth straight year of drought. Fortunately, in 1993, heavy rains and snowfall returned to the Tuolumne River watershed.

Source: California Department of Water Resources

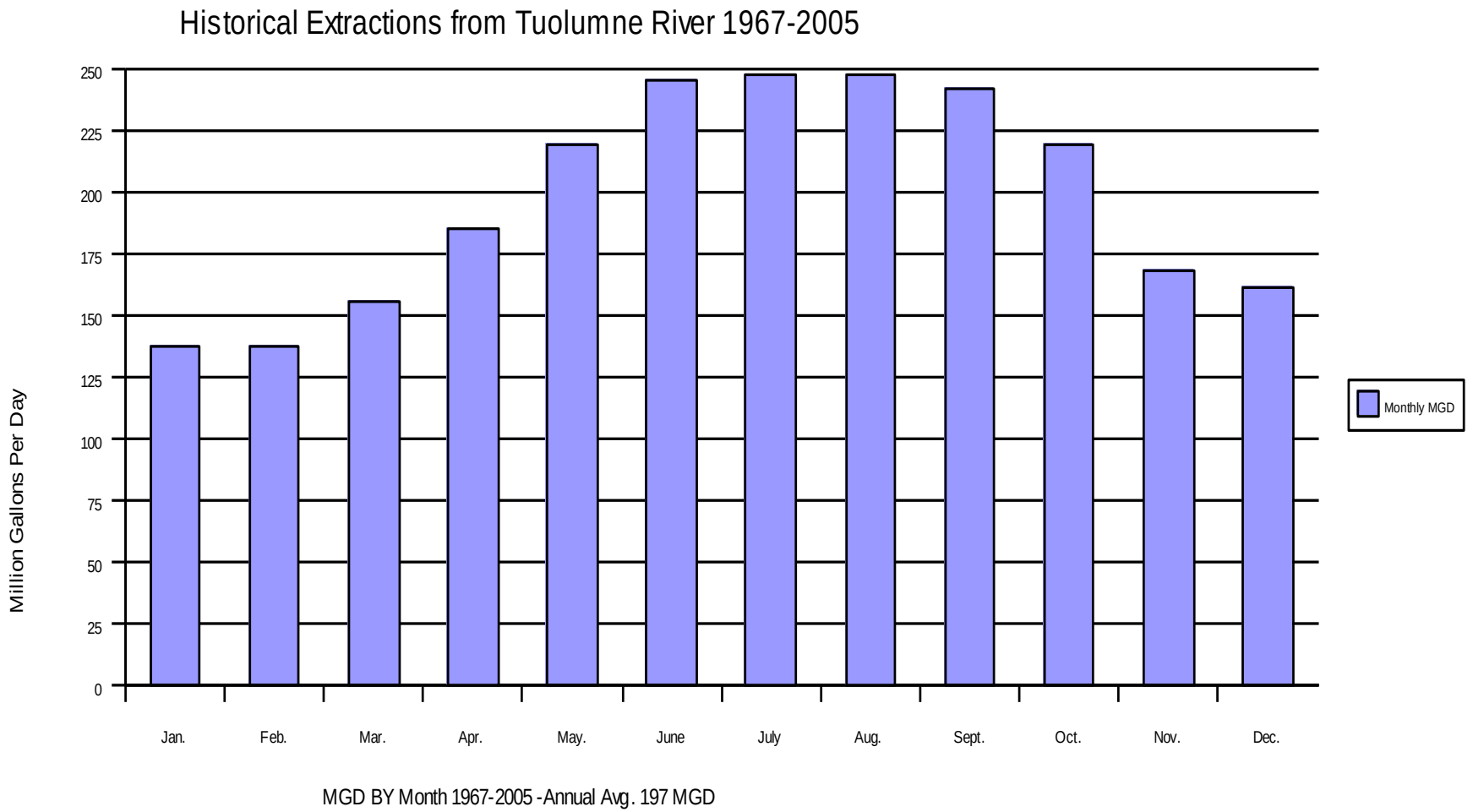
Historic Tuolumne River water rights distribution average and drought periods

Y = thousands of acre-feet x = dates



Between 1987 and 1992, the SFPUC's average annual water-rights accrual was 151,000 acre-feet, about half of its current water-delivery objective.

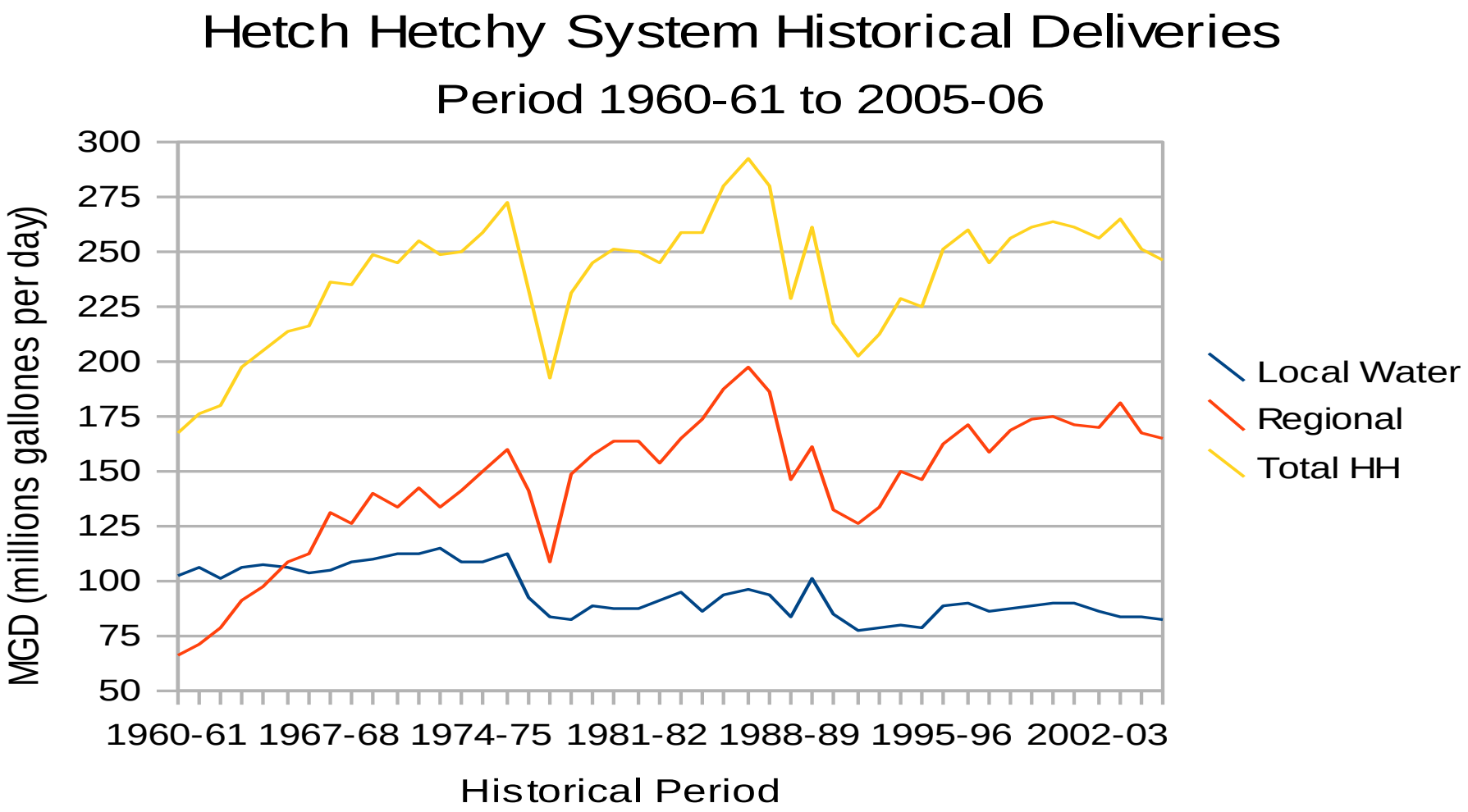
Monthly Average Historical System Extractions from the Tuolumne River 1967-2005
X = month Y = MGD



Average system deliveries for different periods with differences between 265 MGD and 184 MGD

Period	MGD SF Deliveries	MGD Sub. Deliveries	MGD Sys. Deliveries	MGD System StDev	MGD 265-AVG	MGD 184-Subs.
1984/5-2005-6	86	163	250	23	15	21
1970/01-2005-06	91	157	248	21	17	27
1960-61/2005-06	94	145	239	28	26	39

Hetch Hetchy Historical Deliveries



Hetch Hetchy Reservoirs

Principle Tuolumne River and SFPUC reservoirs

Region reservoir	Storage capacity (thousand acre-feet)
Bay Area	
Pilarcitos	3
San Andreas	19
San Antonio	51
Crystal Springs	69
Calaveras	97
Upper Tuolumne	
Eleanor	27
Cherry	273
Hetch Hetchy	360
Lower Tuolumne	
Don Pedro[2] (SF Water Bank)	634
Don Pedro (MID/TID Portion)	1395
SFPUC Total	**1533**

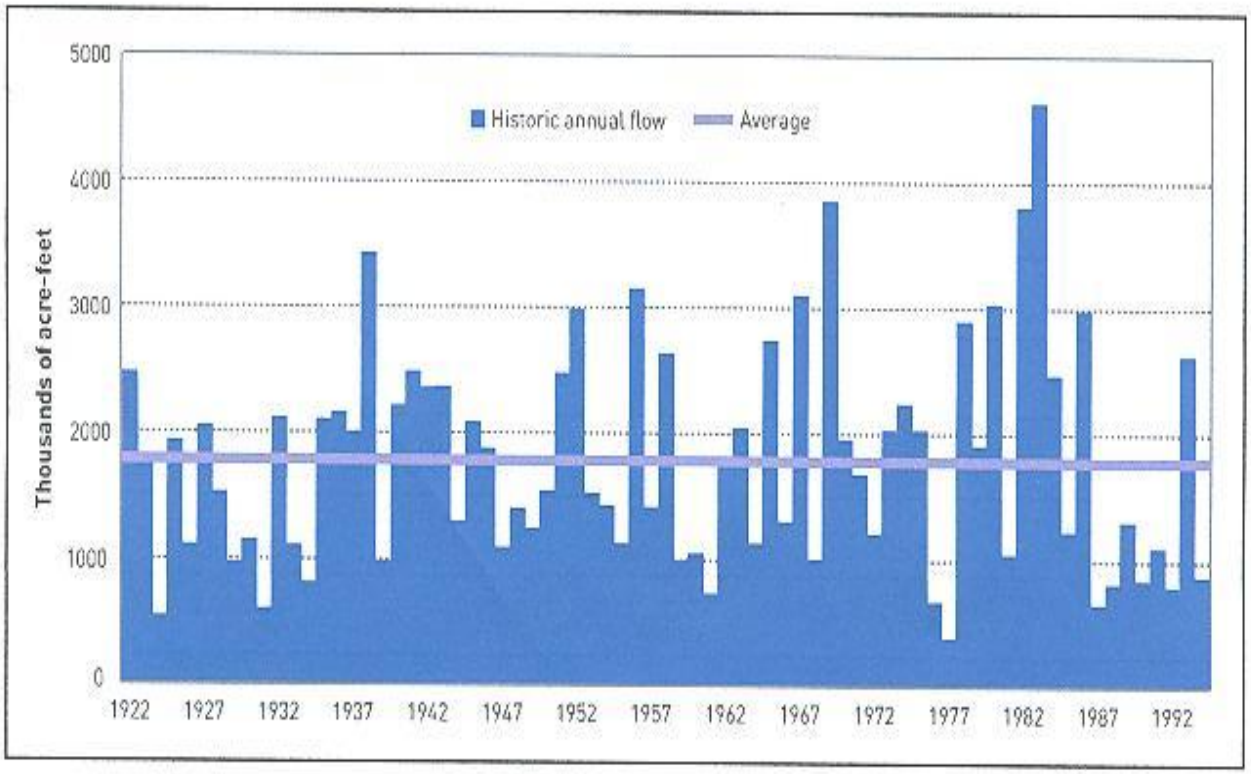
- SFPUC-HH depends on dams to ensure year around supply availability.
- SFPUC own the rights to 740,000 acre-feet storage in Don Pedro. Uses it as a bank to divert upstream river flows.
- State Division of Dams Safety has declared Calaveras (97,000 AF) unsafe and restricts it to 1/3rd rated capacity.
- Total SF BA = 239 AF; Upper TR =660 AF, and Don Pedro (bank) 643 Total SFPUC=1,533 acre-feet

Historic Tuolumne Flows 1922-1994

Y = Thousands of acre feet X = 1922-1992

FIGURE 3-2

Historic Tuolumne River flows (1922–1994)



The Tuolumne's flows, like those of most California rivers, vary widely with annual precipitation. Source: California Department of Water Resources

Hetch Hetch Extractions
@
Different River Flows
@
Percent of Total System Deliveries

Percent of Total TR flows as a result of different delivery assumptions and percent local supplies

SFPUC SYSTEM DELIVERIES MGD	80% FROM TR @ 1.8 MAFY	85% FROM TR @ 1.8 MAFY	80% FROM TR @ 1.1 MAFY	85% FROM TR @ 1.1MAFY
230	11.45%	12.17%	18.74%	19.91%
240	11.95	12.69	19.55	20.77
250	12.45	13.22	20.37	21.64
265	13.19	14.02	21.59	22.94
300	14.94	15.87	24.44	25.97
310	15.43	16.40	25.25	26.83
BAWSCA				
184	9.16	9.73	14.99	15.93
210	10.45	11.11	17.11	18.18

State of California has a keen interest in realistic and reliable forecast of supplies

Wholesale and retail suppliers by state law must show both availability and reliability of water supplies

Water supply/reliability information must be consistent with a variety of legislation and regulations requiring water supply plans, assessments, and verifications

Mainstay is the Urban Water Management Plan (UWMP) – California Code Division 6 Part 2.6 - required at a minimum every five years. Considerable complementary legislation

The UWMP is a growing body of supportive legislation and court rulings.

Four plans, assessments, and verification are required under California law 1.UWMPs, 2. Water Supply Assessment (SB 610), Verification of sufficient water supplies (SB 221), and grownwater management plans (AB 255, AB3030, and SB1938).

- Senate Bill 610 (Costa 2001) – Water supply availability (WSA) – Amends sections of the Public Resource Code and Water Code. Requires a city/county determine if a project is subject to CEQA and must identify water sources for the project. SB 610 changes UWMP to consider availability of ground water. Specific development parameters and is consistent with UWMP.
- Senate Bill 221 (Kuel, 2001) Verification of sufficient water supplies. Leads to strict constraints on number of dwellings and connections in subdivisions unless WSA is verified
- Ground Water Management Plans input for UWMP

AB 255 (1991)

AB 3030 (1992 and amendments)

SB 1938 (Machado 2002)

- Court Rulings – California Supreme Court, February 1, 2007 in Vineyard Area Citizens for Responsible Growth vs. Rancho Cordova articulated certain principles when cases involve water supply for development purposes.
- DWR – somewhat a toothless regulatory. Lead district agency (Planning Dept.) must consider the legislative and regulatory rules in permitting developments subject to CEQA determination – Please carefully read Denise M. Landstedt's detailed analysis. (handout)

Regulatory Approach

- Revenue Requirements = cost of service = allowable (reasonable) costs.
- Rate design by customer class

  Recover costs by various customer classes

  - Residential

  - Commercial

  - Industrial

  -Agriculture

  - Proposition 218 and the Big Bear case on municipal water, wastewater, and power?

Investor Owned Utilities
Establishing Revenue Requirements
by a state (CPUC) regulatory authority

$R = O + D + T + rB$

B = Rate base (V – d)

V = Rate base valuation

d = Accumulated depreciation

R = Revenue requirements

O = Operations and maintenance costs

D = Annual depreciation

T = Taxes

r = Permitted rate of return on the weighted sum of debt and equity capital

Permitted Return on Equity & Debt Capital
IOU type regulatory approach

$r = k(E/C) + i(I/C)$

k = Cost of equity capital

E = Total equity capital

i = cost of debt capital (a weighted average)

C = Total equity and debt capital

Interestingly – as best I can discern the 1984 and now 2009 MWSA use this approach in allocating costs to BAWSCA (BAWUA)

* Does not show income tax impact on debt capital

Self-Regulating Publicly Owned Municipal System Approach

Caveat – This approach does not have to be specifically followed – it is a general approach used in the US

R = O + T + D + C

Where:

R = Revenue requirements

O = Operations and maintenance expenses

T = Tax equivalents

D = Debt service payments (interest charges and principal)

C = Capital expenditures not financed by debt

Possible challenges in 2009 MWSA negotiations

- In addition to being the bearer of bad news that under existing physical system reliability constraints we can't give BAWSCA 184 MGD as a long term average
- The calculation of rate base and allowed return on debt and equity capital could be a thorny issue. As it stands approximately $3.9B will go to rate base and $0.5 Billion in SFPUC's finance (transaction) charges. We could get stuck with the $0.5 Billion?
- These charges include surety, rating agencies, finance studies, issuance, commercial paper-costs, etc.
- SFPUC capitalizes costs during work in construction and then amortized the debt to be passed through as an increase in rates- in the city, this process can be incrementally approached. With BAWSCA it is codified more specifically.
- The rub – balancing two different ways of calculating revenue requirements:
- R = O + D (Depreciation) + T +rB = O + T + D (Debt Service) + C
- As a member of the Task Force I recommended that the SFPUC quit the financial intermediary business. With Ed at the helm, I am induced to change that recommendation.

ECONOMETRIC FORECASTING

Well designed and tested models are integral to planning and implementing a real LTSP. should be driven by appropriate national models UCLA Calif. Model, Wharton, DRI, etc..

- Props. P and E in 2002 may have even mandated a long-term strategic
- A LTSP

- A living and transparent document

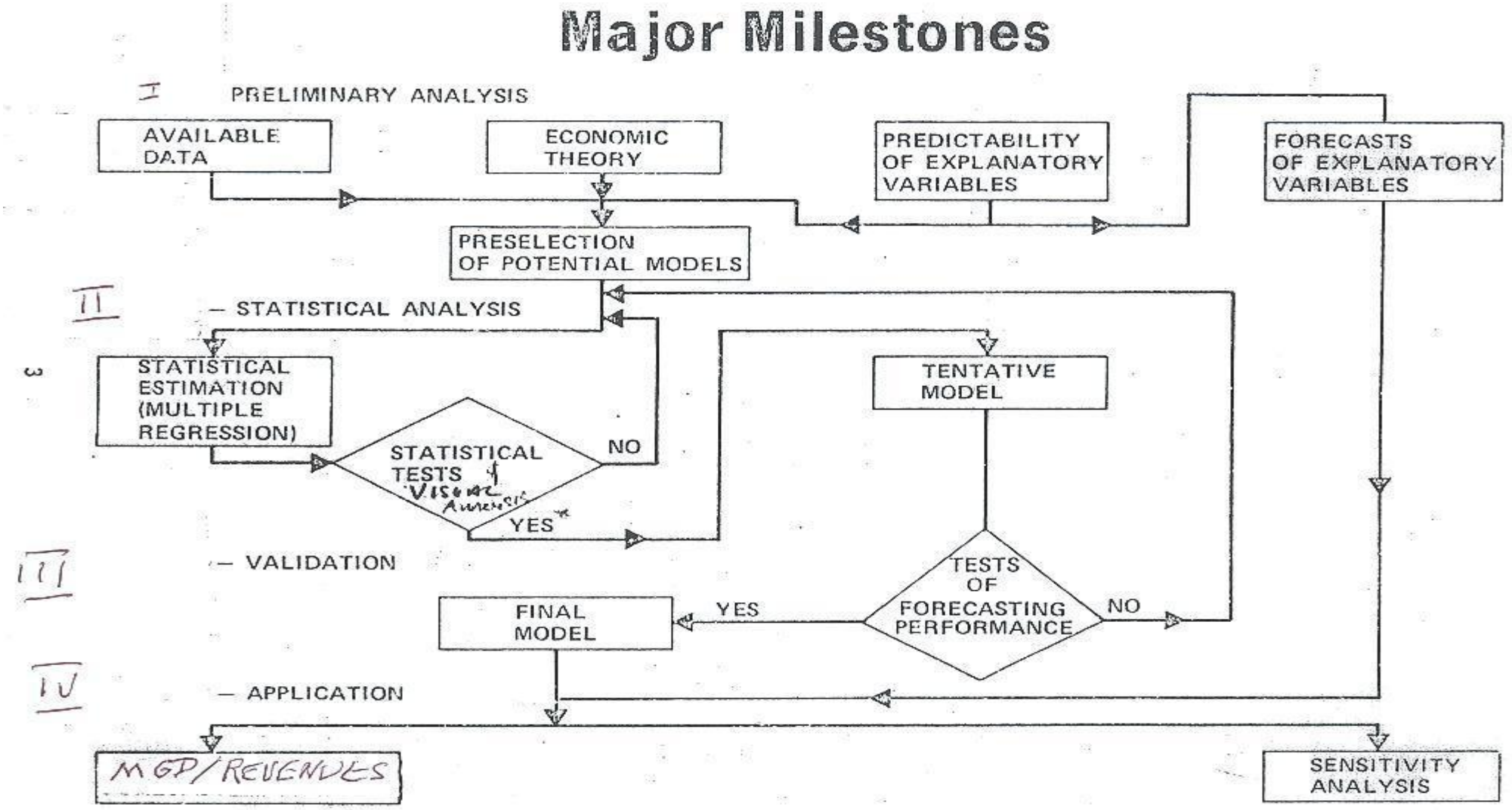
- Where we have been?

- Where we really are today?

- Where we want to go and how?

- Well designed and tested models are integral to planning and implementing a real LTSP.

Econometric Forecasting



Statistical Analysis
Demand Forecasting
Model

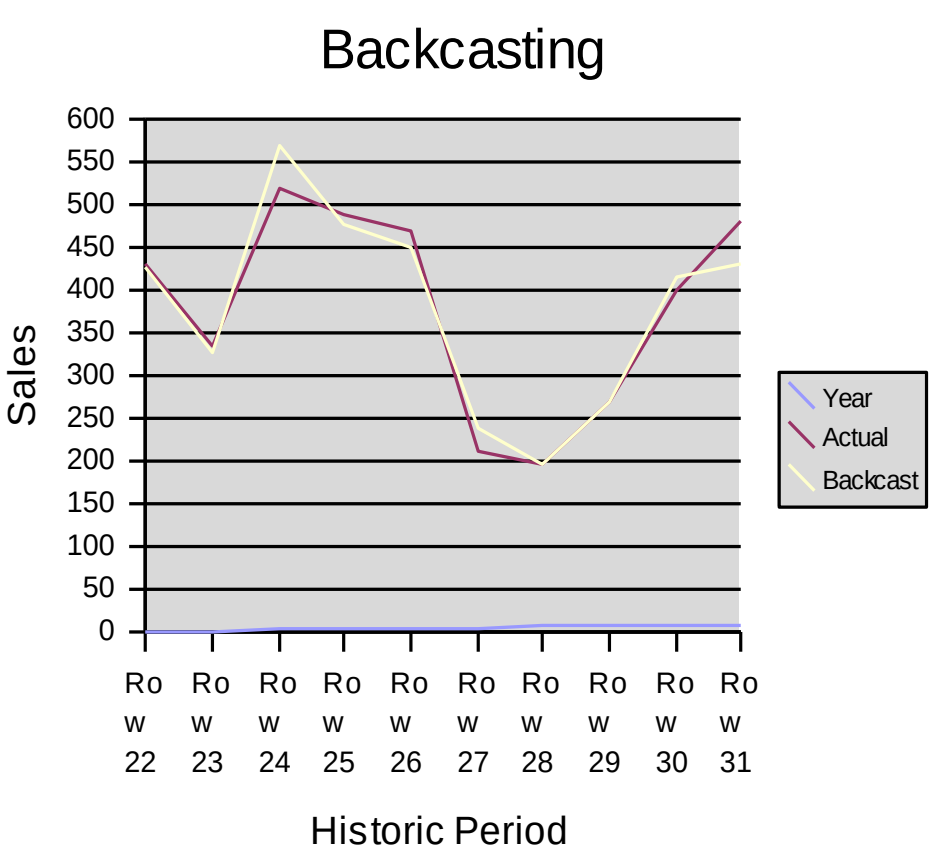
- Method of statistic inference to select the best model (within the class of log-linear models) is ordinary least squares. The model is linearized by logarithmic transformation. This produces an equation wherein the partial regression coefficients are elasticities. An important input into policy formulation.
- The form of the equation may be expressed:

$$\mathrm{Log}_{10}(Y)_t = \mathbf{B}_0 + \sum_{i=1}^{n} B_I \, \mathrm{Log}_{10} X_{I,t}$$

- Where: Log_{10} = Base 10 logarithm; t = Time in years Y_t = MGD (other unit of demand measuring consumption), B_o = A Constant, N = Number of variable, B_I = Coefficient of the I^{th} variable, X_I, t = I^{th} variable.

Testing Statistical Viability of Estimated Equation

- Testing statistical viability of Equation
- Coefficient of determination R^2. Between 0 and 1 indicates how well variations in the independent variable in a a regression explain variations in the dependent variable (,99 = 99%)
- Student's t statistic - tests null hypothesis that the true value of a coefficient in regression analysis is zero.
- F-statistic - Tests the null hypothesis that there is no connection between independent and dependent variables
- Durbin Watson a statistic used in regression analysis to test for the presence of serial correlation
- Standard error for coefficient (SE) – The estimated standard deviation of the estimated coefficient.A samll value of the SE means the coefficient is a more precise estimate of the true coefficient.
- F-statistic -used in regression analysis to test the null hypothesis that there is no connection between the independent variables and the dependent variable.



Some Task Force Recommendations "Power"

Many believe that SFPUC-Hetch Hetchy Power division is the only Federal (Raker Act) mandated municipal power entity in the US.

The Task Force recommended that SFPUC

Sell surplus HH power to the city – wheel not acquire wires.

Gradually ascend retail-utility learning curve and win market share, the old fashioned way, by offering a better widget, not fiat.

Implement pump storage and sleeving programs (etc.) to maximize power output.

Sell high and buy low.

Market out of high priced contracts. Calpine and the irrigation districts – especially in the so called energy crisis.

Adopt a highly entrepreneurial approach to running this enterprise sector.

Do not use funds from the power division other than for power or internalize for

those segments of the system that will complement overall system integrity.