Comments on Load Granularity

Frank A. Wolak
Department of Economics
Stanford University
wolak@zia.stanford.edu
http://www.stanford.edu/~wolak
Chairman, Market Surveillance Committee
California ISO

Pricing Granularity to Load

Pricing Granularity to Load

- California ISO currently uses load aggregation point (LAP) pricing to loads
  - All customers in each investor-owned utility's service territory pays load-distribution factor (LDF) weighted average price
- Generation units are paid or pay the locational marginal price (LMP) at their node for all energy they buy or sell
- California ISO considering introducing greater pricing granularity
  - September 21, 2006 Federal Energy Regulatory Commission (FERC) order required increased granularity in Release 2, three years after start of new market
    - This would mean by April 1, 2012

Pricing Granularity to Load

- Many market efficiency benefits to greater granularity in pricing to load
  - Enhance efficiency of day-ahead market by eliminating requirement that LAP demand be allocated to nodes according to fixed load-distribution factors (LDFs)
    - Load-serving entities would schedule at the nodal level
  - Scheduling at nodal level would allow individual retailers to determine their exposure to nodal prices rather have this determined by LDFs chosen by California ISO
  - Incentive for energy efficiency investments to occur where they provide the greatest system-wide benefits
    - For example, saving 1 KWh reduces customer's bill by 15 cents/KWh in high-priced area versus 12 cents/KWh in low-priced area
    - More energy efficiency investments will occur in high-priced areas, where they provide greater system-wide benefits
  - Increased incentive for consumers to favor transmission expansions that benefit wholesale market efficiency
    - Consumers have less incentive to favor socially beneficial transmission expansions from low-priced area to high-priced area if everyone faces same LAP price

Pricing Granularity to Load

- Limits competition among generation unit owners to supply major load centers in California
  - Areas with little transmission into them more likely to remain so
- Perpetuates need for local market power mitigation mechanisms
  - Local market power mitigation mechanisms have bid adders and other mechanisms that raise average prices and limit wholesale market efficiency
- Eliminates potential loopholes in market monitoring process that can arise from asymmetric treatment of load versus generation
  - Limits opportunities for market participants to buy or sell at LAP price and sell or buy at nodal price
    - Market participants can profit from this activity which has little, if any, market efficiency benefits

Pricing Granularity to Load

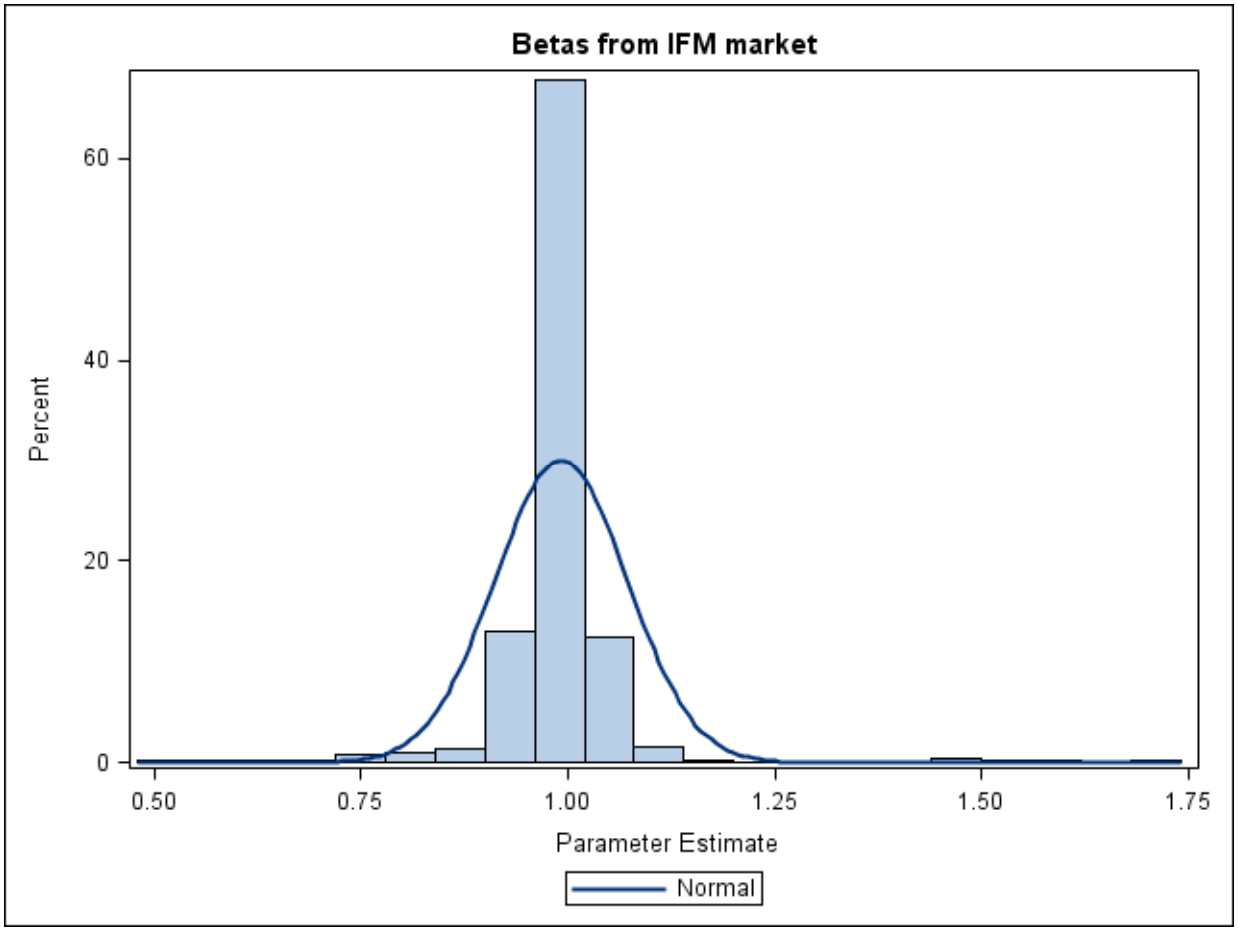
- Important fact about LAP pricing
  - LAP pricing does not protect California consumers from paying high spatial prices
  - Each hour, the total amount paid to generation unit owners is greater than total amount collected from retailers
    - California consumers pay high spatial prices
    - Consumers in low-priced areas subsidize consumers in high-priced areas
  - LAP pricing only prevents individual market participants from fully benefitting from taking actions to limit the magnitude of spatial price differences
- Markets work best when participants are charged market price for product they consume
  - Imagine charging business and leisure travelers the weighted average of the business fare and leisure fare on a flight
  - Leisure demand would fall and business demand would rise and average prices would increase
    - Similar logic holds for LAP pricing, because customers in high priced areas have less incentive to limit these prices and customers in low-priced areas have too large of an incentive to reduce their demand

Pricing Granularity to Load

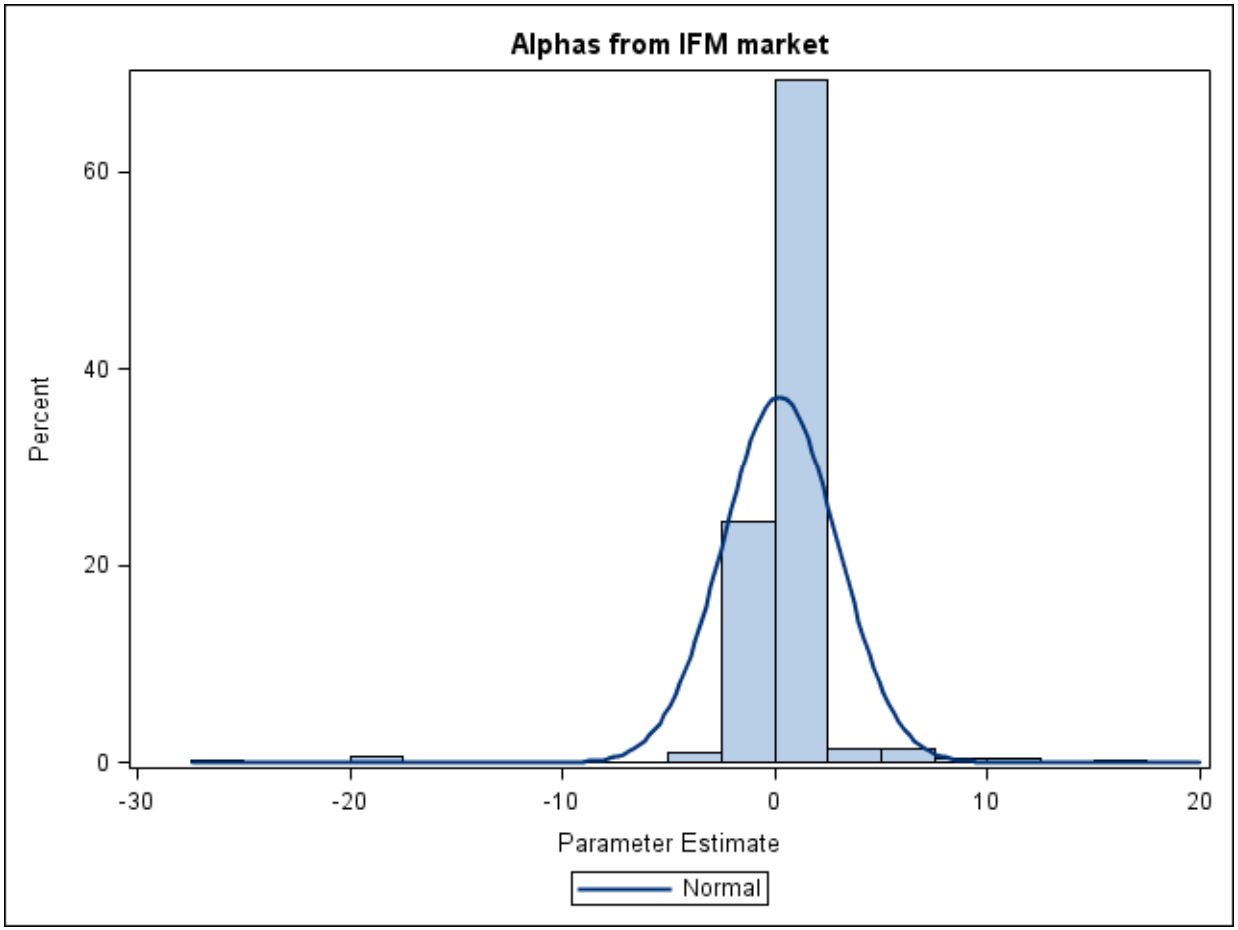
- Costs of greater spatial granularity
  - Retailers would have to make up-front costs to change billing systems
    - This argues against phased transition to nodal pricing to loads
  - LAP pricing to loads increases need for load-serving entities to engage in nodal convergence bidding
    - Only mechanism to protect themselves from divergence between day-ahead and real-time nodal prices
  - Potential increased cost to forecast nodal-level demand
    - Depending on how retailer forecasts its demand
  - Customers currently receiving subsidies through LAP pricing must pay higher prices
    - Customers receiving subsides, pay lower prices
    - Can manage transition through CRR allocation process

Pricing Granularity to Load

- Measuring spatial price variation
  - For each nodal price that enters one of the three default LAP prices, run regression for period 4/1/2009 to 8/31/2010
  - $P(i,h,k) = \alpha_i + \beta_i * PLAP(h,k) + \varepsilon_i$
  - $P(i,h,k)$ = price at node i in LAP k during hour h
  - $PLAP(h,k)$ = price for LAP k during hour h
  - If $E(P(i,h,k)) = E(PLAP(h,k))$, then $\alpha_i = 0$ and $\beta_i = 1$
  - To the extent that these restrictions do not hold, there are systematic differences
  - If $\beta_i > 1$, then movements in PLAP(k,h) predict larger moments in P(i,h,k)
  - If $\beta_i < 1$, then movements in PLAP(k,h) predict smaller moments in P(i,h,k)
  - If $\alpha_i > 0$, then mean prices at P(i,h,k) are higher than mean of PLAP(h,k)
  - If $\alpha_i < 0$, then mean prices at P(i,h,k) are lower than mean of PLAP(h,k)

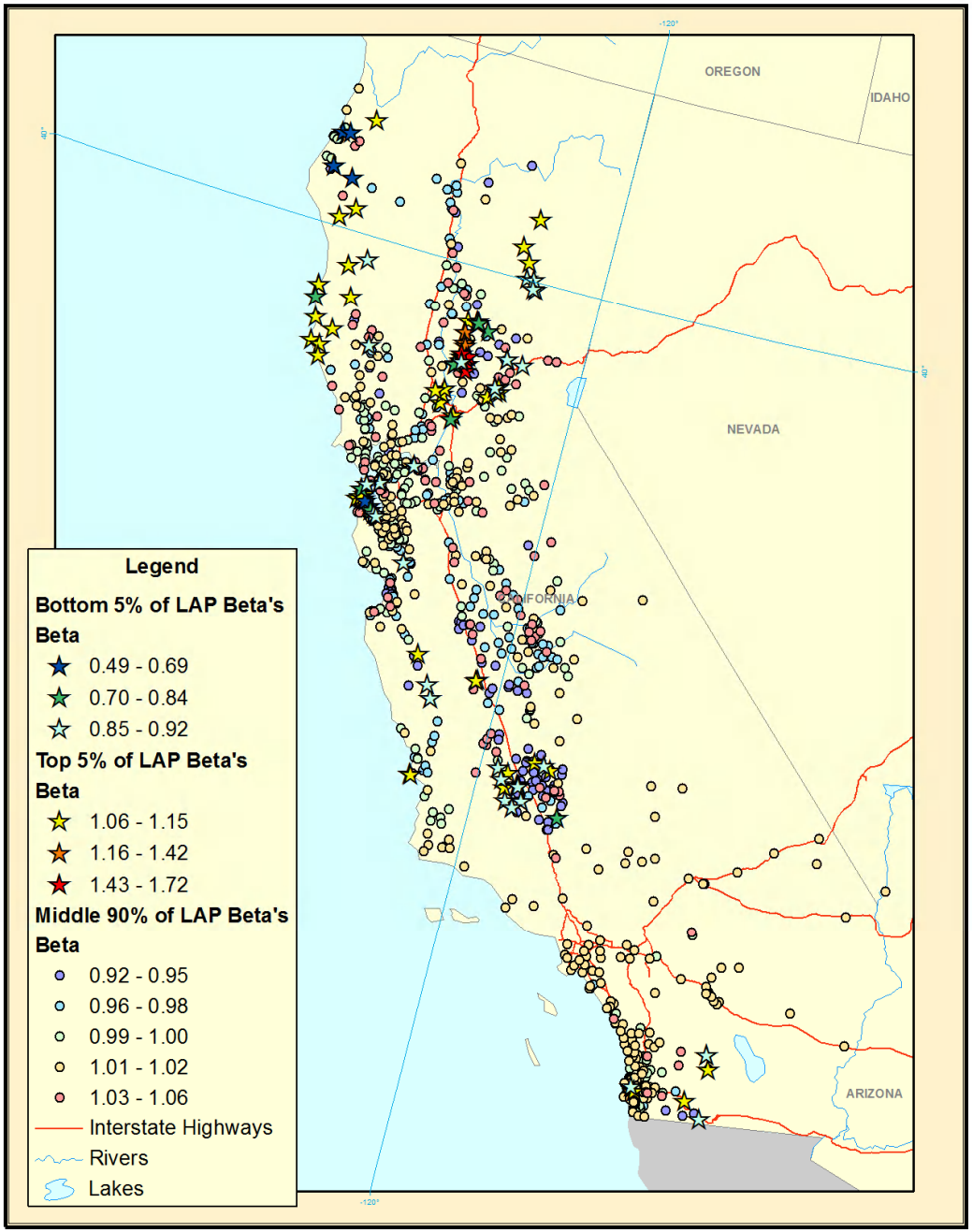


Distribution of β_i

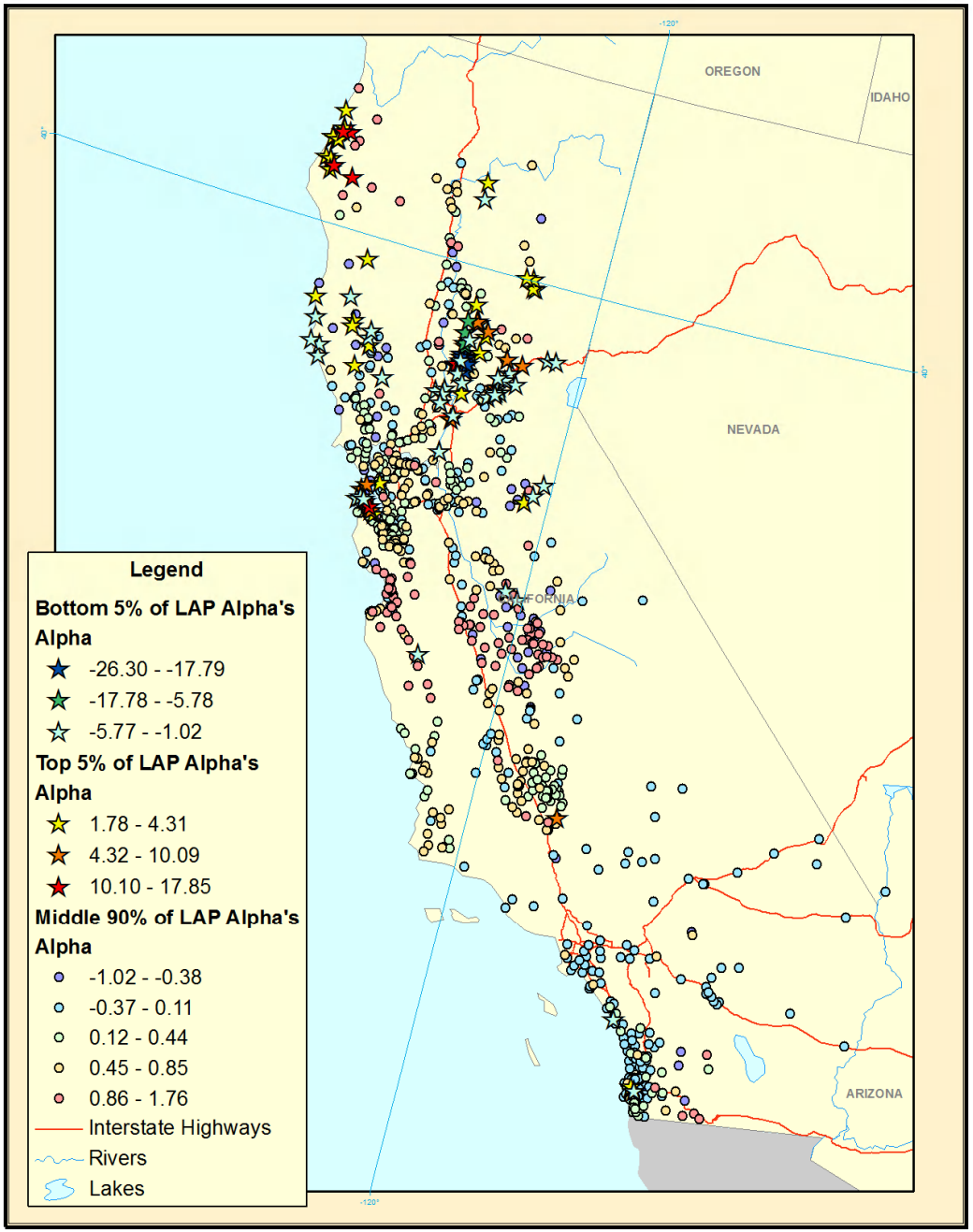


Distribution of α_i

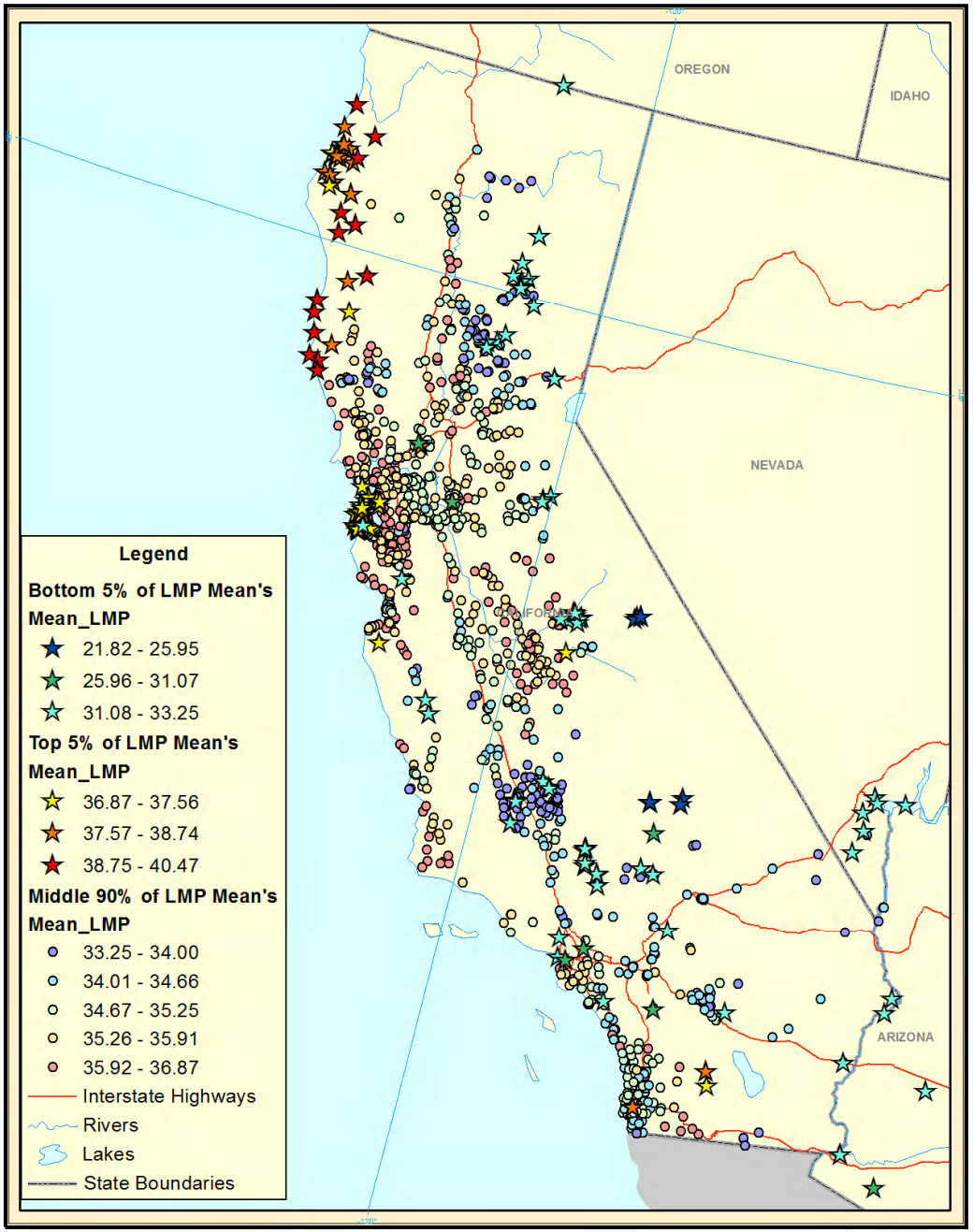
Spatial Distribution of β_i



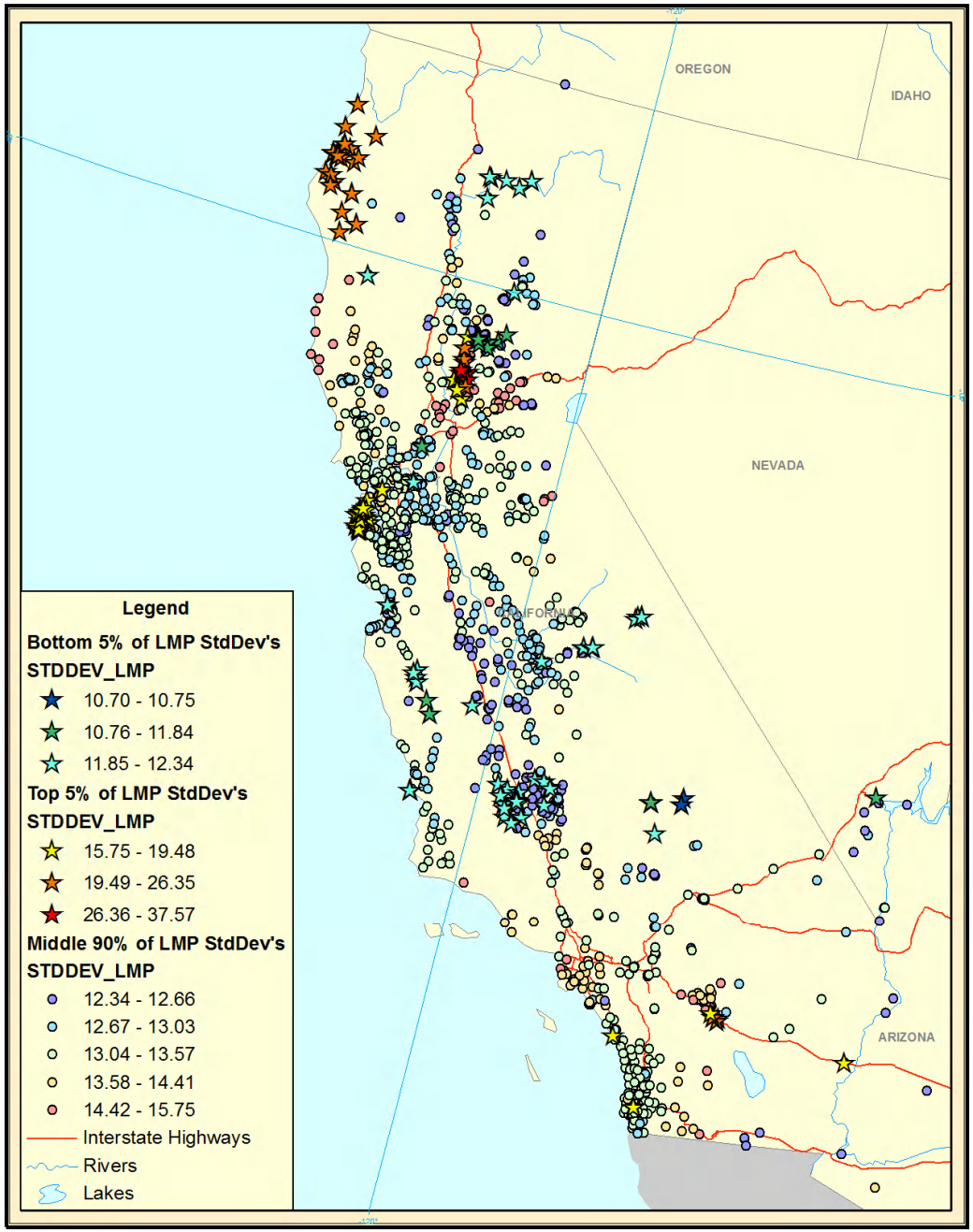
Spatial Distribution of α_i



Spatial Distribution of Mean Hourly Prices



Spatial Distribution of Standard Deviation of Hourly Prices



Pricing Granularity to Load

- Conclusions from analysis
  - Majority of locations $\beta_i \approx 1$ and $\alpha_i \approx 0$
  - Particularly locations near major load centers
  - Large and small β_i locations tend to be electrically disconnected areas
  - Large and small α_i locations tend to be near major load centers or generation pockets
- Overall conclusion—Majority of spatial price variation can be explained by transmission network configuration, which are legitimate costs of serving load at these locations

Pricing Granularity to Load

- Difficult to argue against full nodal pricing to load on market efficiency or equity considerations
  - One-time cost of change argues in favor of single change in spatial pricing granularity
  - Almost 2-year advance notice should be sufficient for market participants to adapt
    - CPUC can take longer by delaying spatial differentiated pricing to IOU customers
  - CRR allocation process can limit extent that average retail prices at high-priced locations must increase

For More Information

http://www.stanford.edu/~wolak