ERP Small Wind Study

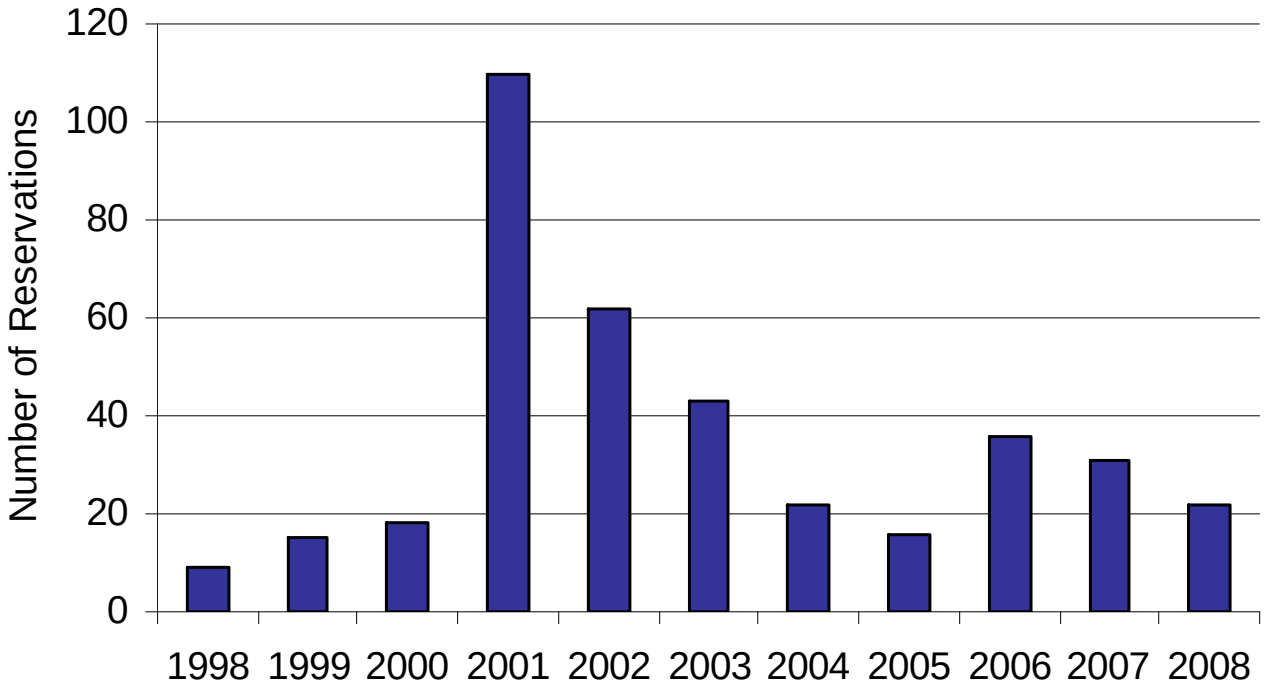
Market infrastructure, economics, and market barriers

California Energy Commission Staff Workshop on Possible Changes to the Emerging Renewables Program Guidebook

July 21, 2009

Objectives of the Study

- Describe California's small wind infrastructure
- Understand the barriers to small wind consumption
- Provide recommendations for ERP to decrease or eliminate these barriers



Presentation Outline

- Describe California's small wind infrastructure
  - ERP's Role
  - Manufacturers
  - Retailers/Contractors
  - Customers
- Understand the barriers to small wind consumption
  - Major barriers to small wind
  - Economics and performance analysis
- Provide recommendations for ERP to decrease or eliminate these barriers

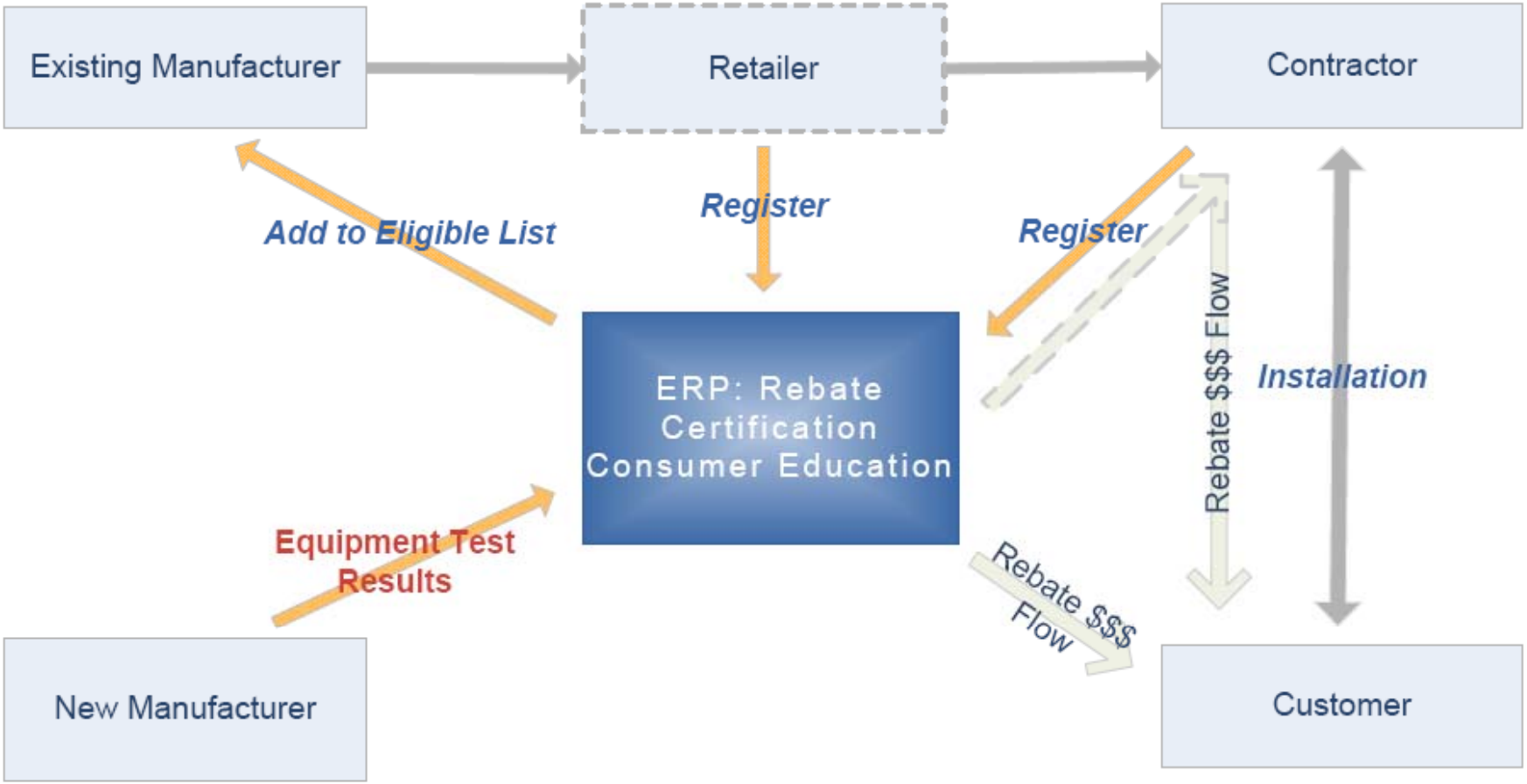
ERP's Role in California's Small Wind Market

- Rebate
  - $2.50 per Watt for the first 7.5 kW
  - $1.50 per Watt for increments between 7.5 kW and 30 kW
  - Qualified affordable housing projects receive a rebate 25% higher than the standard rebate, up to 75% of the system cost.

- Equipment Certification
  - IEC 61400-2; or
  - Average energy produced (kWh) and wind speed for 12 consecutive months

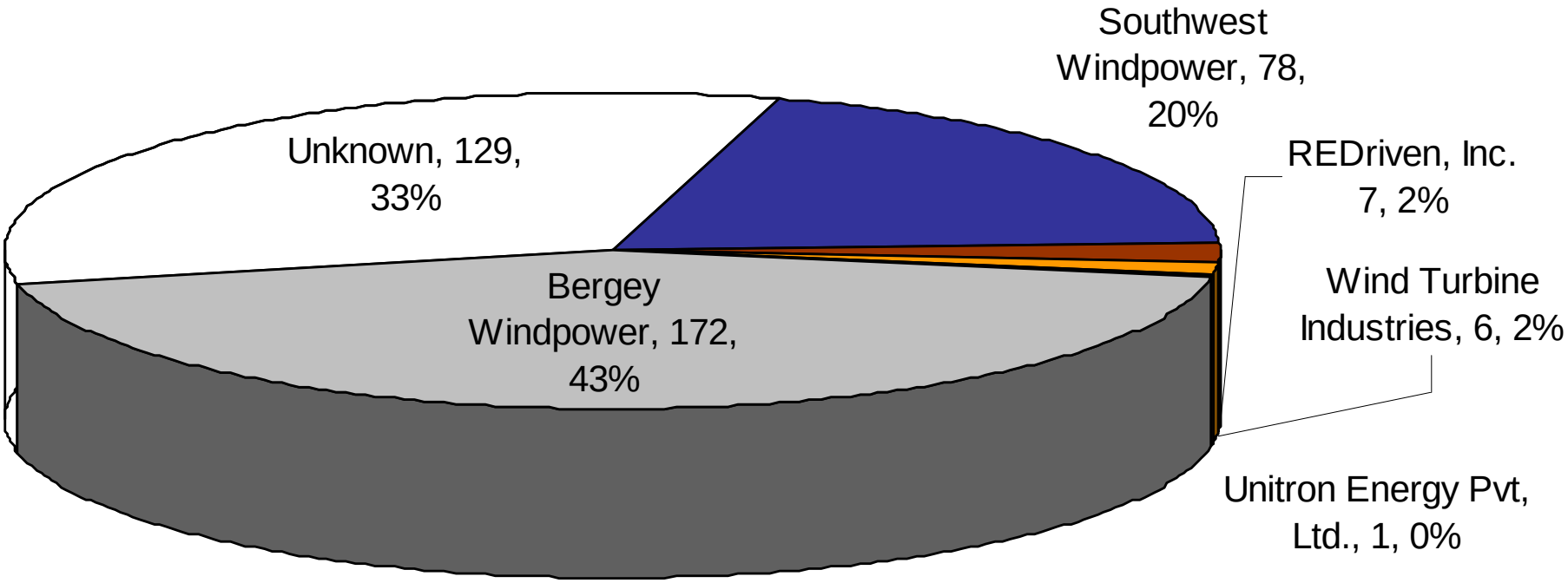
- Consumer Education

California's Small Wind Infrastructure



Manufacturers and Equipment

- 64 Wind turbines on the ERP list (24 manufacturers), only 12 models are known to have received rebates (5 manufacturers)
- However, for contractors, access to appropriate wind turbines is only a minor barrier



Retailer/ Contractor

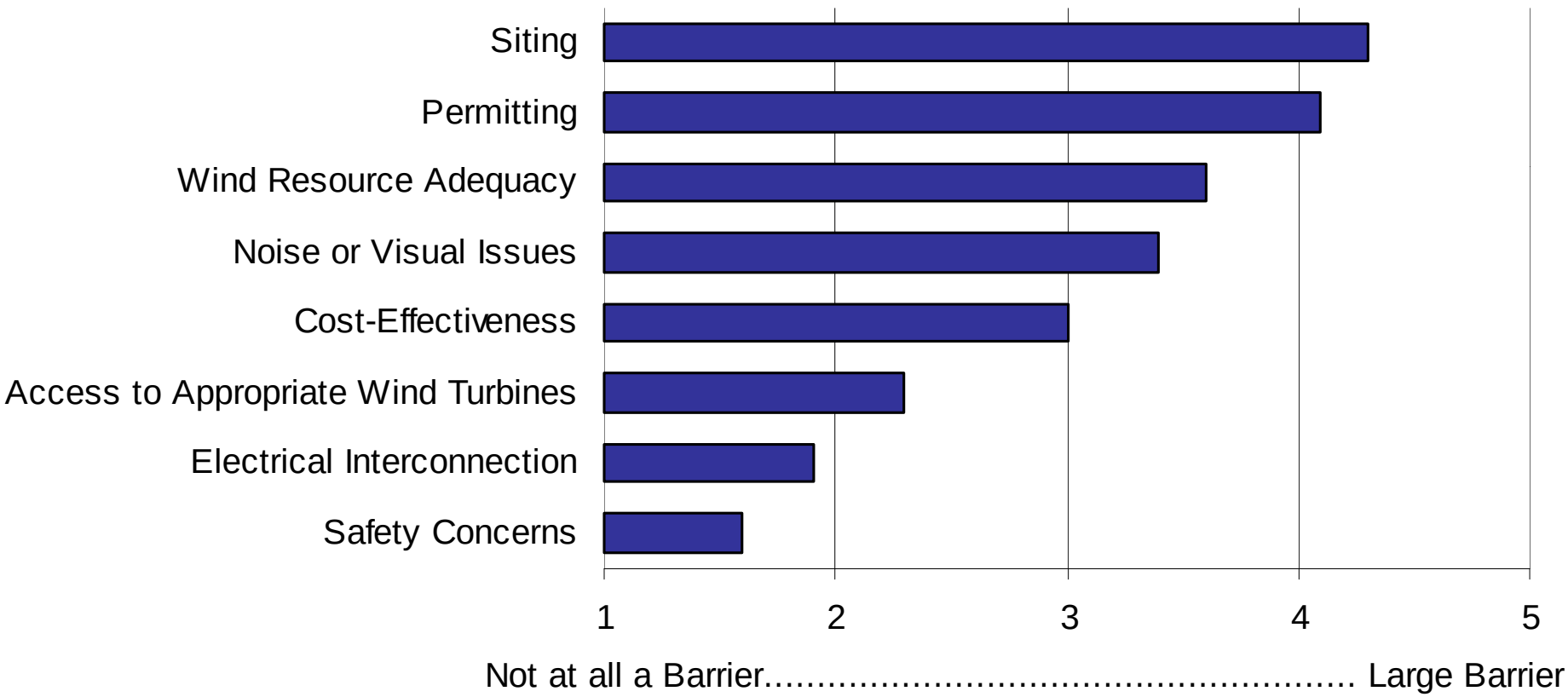
- Many retailers in the ERP are also solar equipment retailers and/or contractors
- Retailers
  - In general, ERP customers are satisfied with their retailers or the equipment purchasing experience with their retailer-contractor (Satisfaction = 3.9/5.0)
  - Mixed opinions about the number of retailers in CA
- Contractors
  - At least 47 owner-installer
  - At least 29% of all systems are installed by Guasti Construction and almost half of the completed systems are installed by seven installers
  - One manufacturer believes that CA has lost 75% of its contractors because of discouraging permitting processes and a decrease in demand

Customer Satisfaction

- In general, small wind customers are satisfied with their systems.
- 68% of the customers who responded would purchase their system again. A few mentioned that they would even have a larger system.
- 80% of respondents would recommend wind generating systems to others.
- For those dissatisfied with their small wind experience, the most common complaints included permitting cost and time, poor contractor competency, property tax increases, less-than-expected system performance and payback, and resource adequacy. Aside from these major complaints, there were minor concerns with warranty, retailer, ERP rebate, performance monitoring, and maintenance.

Major Barriers to Small Wind

- Supply-Side Perspective



Permitting

- Permitting time and costs vary widely between counties and, in some cases, within a county
  - Permitting time is reported to take between 10 hours in Kern County to 18 months in San Bernardino County
  - Costs could range from less than $500 in Yuba County to over $10,000 in Shasta County.
- 2009 Contractor Survey Results from 23 counties
  - More than half rated permitting difficulty as 4 or 5 out of 5 (most difficult), with San Diego County and Imperial County as two of the most challenging.
  - Only a handful of counties received a rating of 1 or 2 for being the easiest to obtain permits; Yuba, Butte, Kern and Glenn Counties are reported to have relative fast and reasonably-priced permits.
- On average, customers feel “neutral” about the permitting process

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Resource Adequacy

- Contractors and retailers on average identified resource adequacy as an average to large barrier
- ERP customers listed resource adequacy as one of their top five complaints in the 2009 survey
  - Insufficient wind in their area → system output was compromised
  - Wind system would go into standby when the wind resource was too high → Not able to take advantage of the wind when it was most abundant.
- Site monitoring is expensive and time consuming
- Wind maps are inadequate
  - Measured at higher altitudes
  - Lack granularity
  - Lack seasonal, monthly or daily variations
  - Does not consider local topography, eg. trees, building structures

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Noise and Visual Issues

- In the manufacturer/installer survey, respondents identified visual and noise issues as “somewhat a barrier.” (3.6/5.0)
- These issues are more pronounced among building departments and communities that contribute to the difficulty in obtaining permits.
- In the customer survey, two respondents mention complaints from neighbors:
  - one of them complained about excessive noise, causing the owner to stop using the system;
  - the other complaint was launched during the permitting process, causing a six-month delay in obtaining the permits.

Costs

- System costs in the ERP vary – 80% of the systems in the ERP range from $3 to $8 per installed watt (before rebate).
  - Average: $6.14/Watt
  - Median: $5.39/Watt
- Two distinct cost averages:
  - Small systems (<9kW) averaged between $7.00 and $7.50 /watt;
  - Larger systems (>9kW) averaged around $5.00 per watt
- Costs trends
  - Contractors/manufacturer: costs in the past five years have increased between 10 to 28 %
  - Mostly due to higher hardware, installation, and permitting costs.
  - Since wind turbines rely on steel and concrete for their structures, the costs are tied to the increase in commodity price over the past few years.

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System Installation and Performance

- 90% of the customers surveyed still have operational systems
- 69% found their systems performing “Better than Expected” (21%) or “As Expected” (48%)
- Reported system problems:

Problems with system?		
Mechanical	24	20%
Electrical	21	17%
Low wind	32	26%
Warranty issue	5	4%
No problem	39	32%
Others	37	31%

- Other problems include early turbine cutout in high winds (4), general inverter problems (5), structural mounting failure (2) and excessive noise.

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Product Reliability

- Currently, there is no requirement for third-party verification of performance curves
- IEC 61400-2 is a very rigorous certification standard, but most manufacturers opt for self-reporting 12 consecutive months of output
- Small wind product reliability limits retailers' and contractors' choices in the market
- For the few contractors who experimented with new products, complaints were cited about the products' durability, inflated performance ratings, and some were simply described as "junk."
- The Energy Commission does not have a mechanism to regulate manufacturers that exaggerate their products' performance and therefore may unintentionally give an unfair advantage to poor performers.

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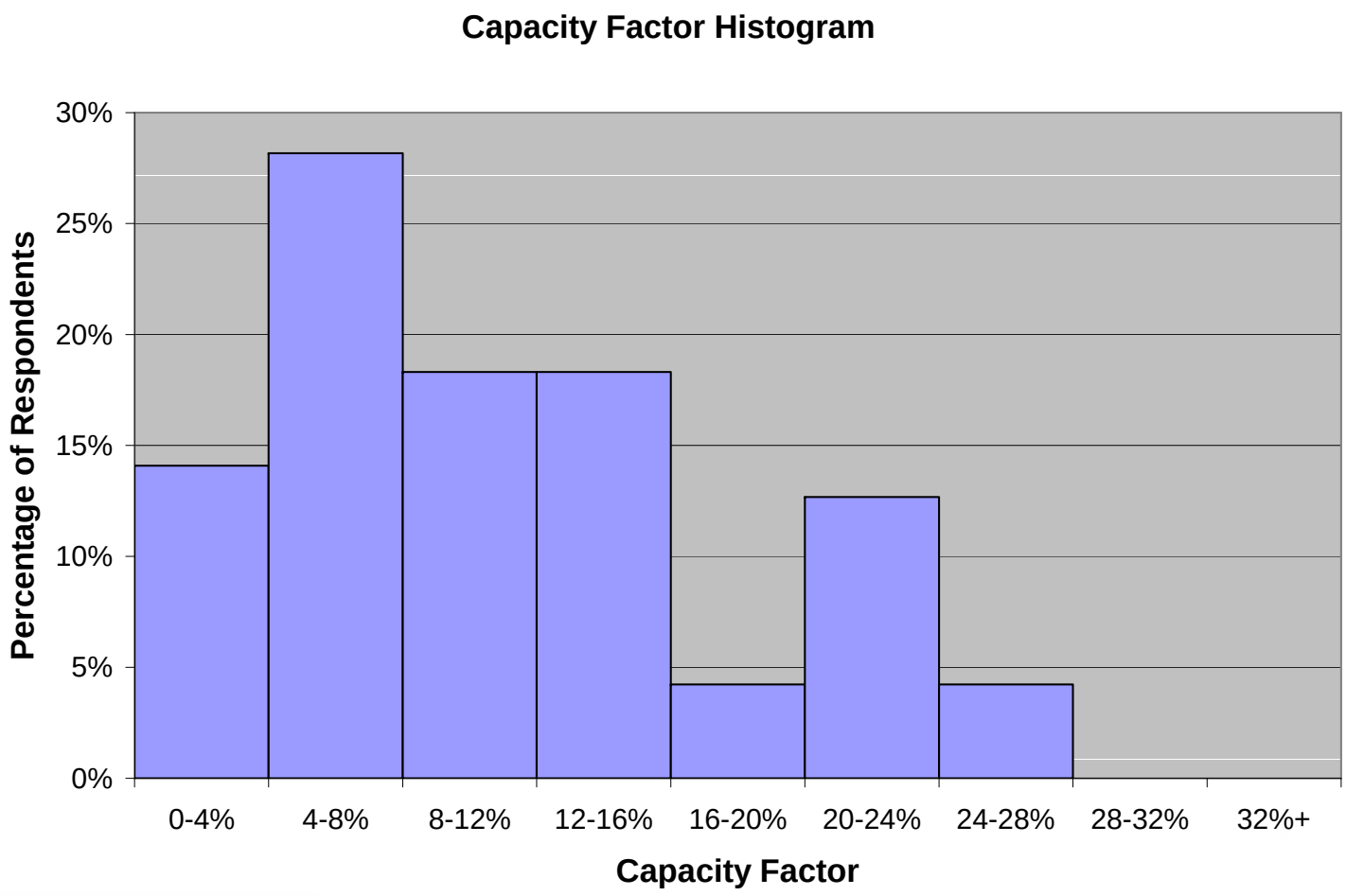
Other Barriers Mentioned in the Surveys

- Property tax
- Retailer and contractor quality
- Warranty
- Financing
- Utility Billing

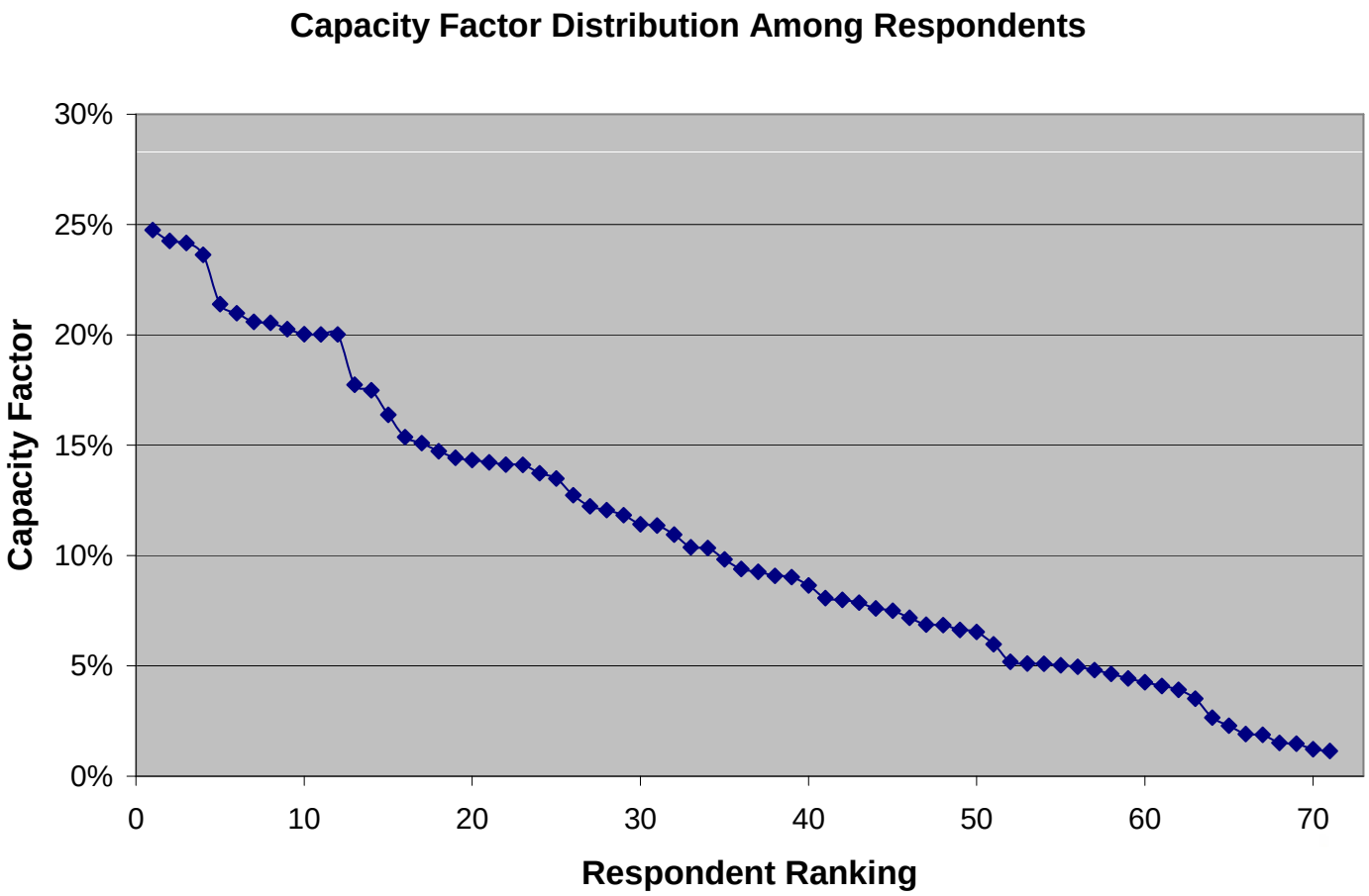
Performance Analysis – Capacity Factors

- The capacity factors trend toward the mid-teens and below
- Average capacity factor: 10.7%; Median 8.4%



Performance Analysis – Capacity Factors

- Large range of capacity factors is not unusual with wind systems of any size. Each turbine and each location are designed differently.



Note: 71 out of 121 (59%) respondents provided enough accurate information for calculation of capacity factor.

Customer Payback Expectations

- 75% paid for their systems with cash, while 22% at least partially financed the system, and only 2% leased the system.
- This suggests also that the respondents perceive the systems as a capital investment—a purchase with a large upfront cost and a perceived payback.

Expected payback of wind system		
5 years or less	16	13%
6–10 years	61	50%
More than 10 years	40	33%
Other	4	3%

- 47% did not have a changed expectation of payback, while 35% reported a change in expected paybacks that are skewed toward longer paybacks than the first estimates,

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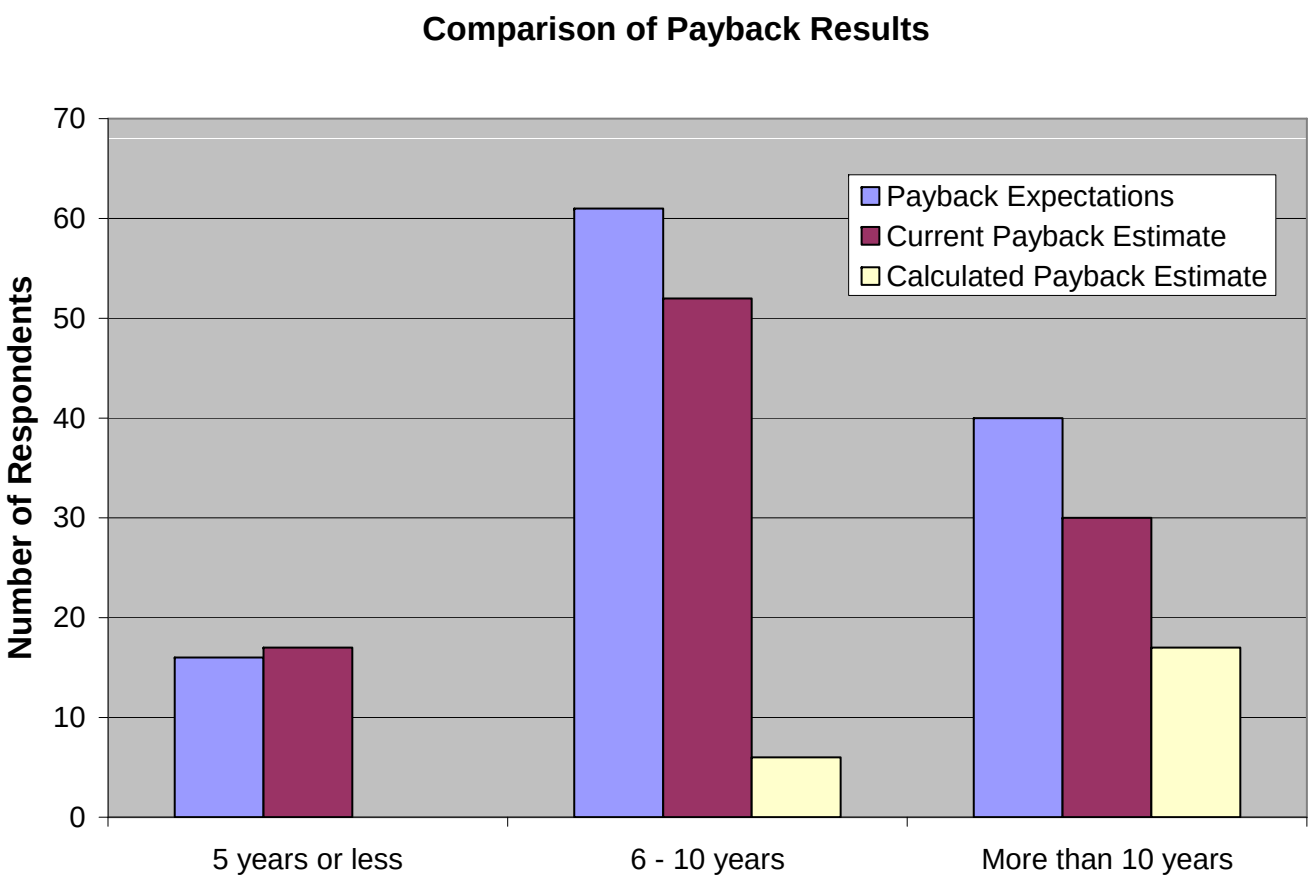
Calculated Payback vs Expectations

- Calculated payback range: 6-100 years (Historical; no ITC)
  - Average: 30.3 years (value skewed by outlying long paybacks)
  - Median: 21 years



Note: There were significantly fewer responses to the questions used to calculate payback.

Small Wind Economics with ITC

Expected Capacity Factor	10 kW		<3 kW	
	Simple Payback [years]	Discount Payback [years]	Simple Payback [years]	Discount Payback [years]
4.0%	15.4	Never	Never	Never
8.0%	8.3	10.9	16.7	Never
11.0%	6.2	7.5	12.7	19.8
14.0%	4.9	5.7	10.2	14.4
18.0%	3.9	4.3	8.1	10.6

- Assumes system cost for 0-3kw = $7500/kW; 10kw= $5000/kW; electrical price= 0.20/kwh; Discount rate= 5%; Lifespan = 20 years

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Residential PV Economics with ITC

Expected Capacity Factor	Simple Payback [years]	Discount Payback [years]
14.0%	16.5	Never
15.0%	15.6	Never
16.0%	14.7	Never
17.0%	14.0	23.2
18.0%	13.3	21.4

- Assumes system cost = $9000/kW; electrical price= 0.20/kwh; Discount rate= 5%; Lifespan = 25 years

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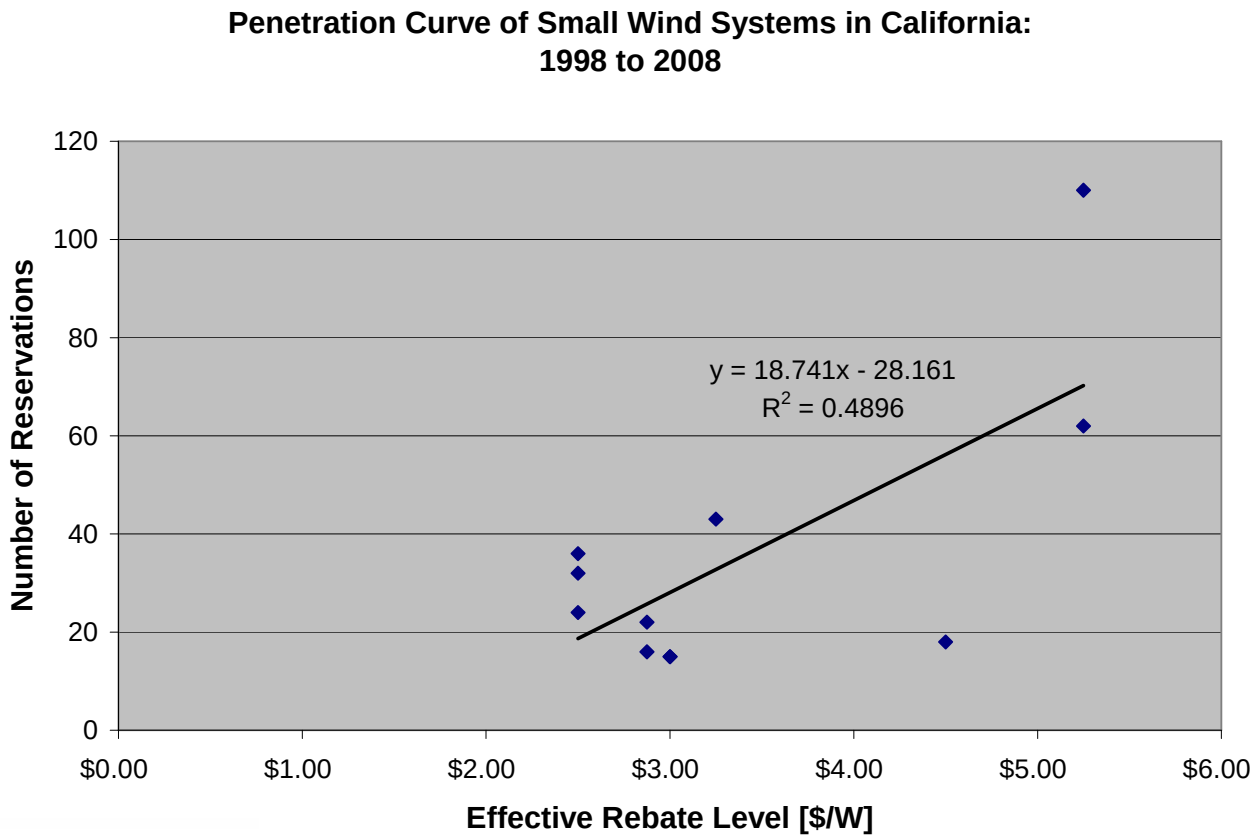
Number of systems vs. Rebate Level

- There is a general trend that shows that installations will increase with rebate amount.
- This relationship is not truly linear; The data shows a significant spread, with the R^2 value of 0.4896



Recommendations – Turbine Certification

- Performance Certification
  - Require certification to IEC 61400-12-1 “Power performance measurements of electricity producing wind turbines” by a qualified third party. This standard provides a uniform method that will ensure consistency and accuracy in the measurement and analysis of power performance
- Safety, Quality, and Durability Certification
  - A more comprehensive certification protocol should be implemented to account for a products’ overall quality (including performance, acoustics, durability and safety). AWEA has developed a standard (AWEA 9.1 – 2009) for this purpose with the intent to have products certified by the Small Wind Certification Council (SWCC).
  - Electrical safety of the generator: UL 1004-1; UL 1004-4

Recommendations – Inverter Certification

- Remove the requirement for the conversion efficiency test as currently defined in the *ERP Guidebook*.
- Remove the requirement for the maximum continuous output power test for wind turbine generators (or fuel cell generators) with integral inverters. This test requirement would remain in place for separate inverters to be used with wind turbines.
- Develop a new equipment listing with inverters applicable to wind turbine and fuel cell systems. Therefore inverters suitable only for PV systems will not be included on the ERP inverter listing.

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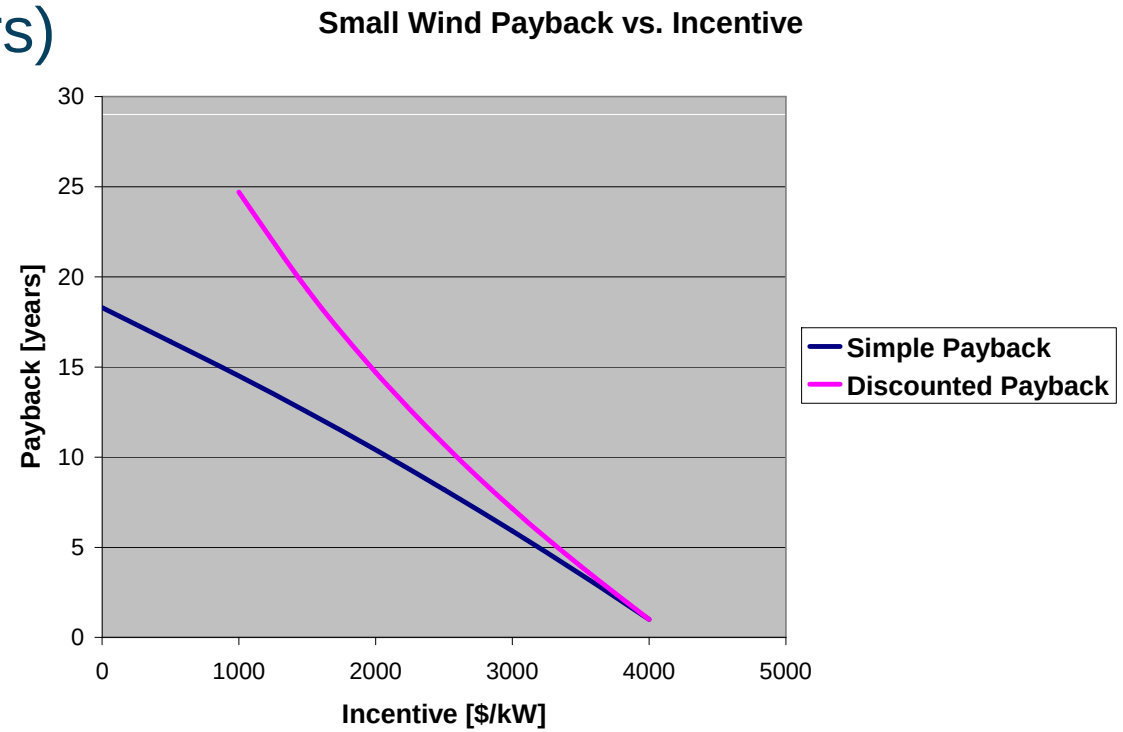
Recommendations – Rebate Level and Structure

- No change
  - With uncapped ITC, the rebate yields a discounted payback within the customers' expectations (6-10 years)



- Assumes system cost = $6000/kW; electrical price= 0.20/kwh; Discount rate= 5%; Lifespan = 20 years; 30% ITC, Capacity Factor = 11%

Recommendations – Others

- Production estimation tools
- Wind maps specific for small wind
- Permitting Support
- Inspection and Monitoring
- Installer Education and Training
- Consumer Education and Marketing
- Definition of Small Wind

Recommendations Overview

ERP's Role	Recommendations
Rebate	• No Change
Equipment certification	• Turbine Performance Certification • Turbine Safety, Quality, and Durability Certification • Inverter Certification
Consumer Education & Outreach	• Production estimation tools, Wind maps for small wind • Inspection and monitoring • Installer Education and Training, Consumer Education and Marketing

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Thank you for your attention.

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