



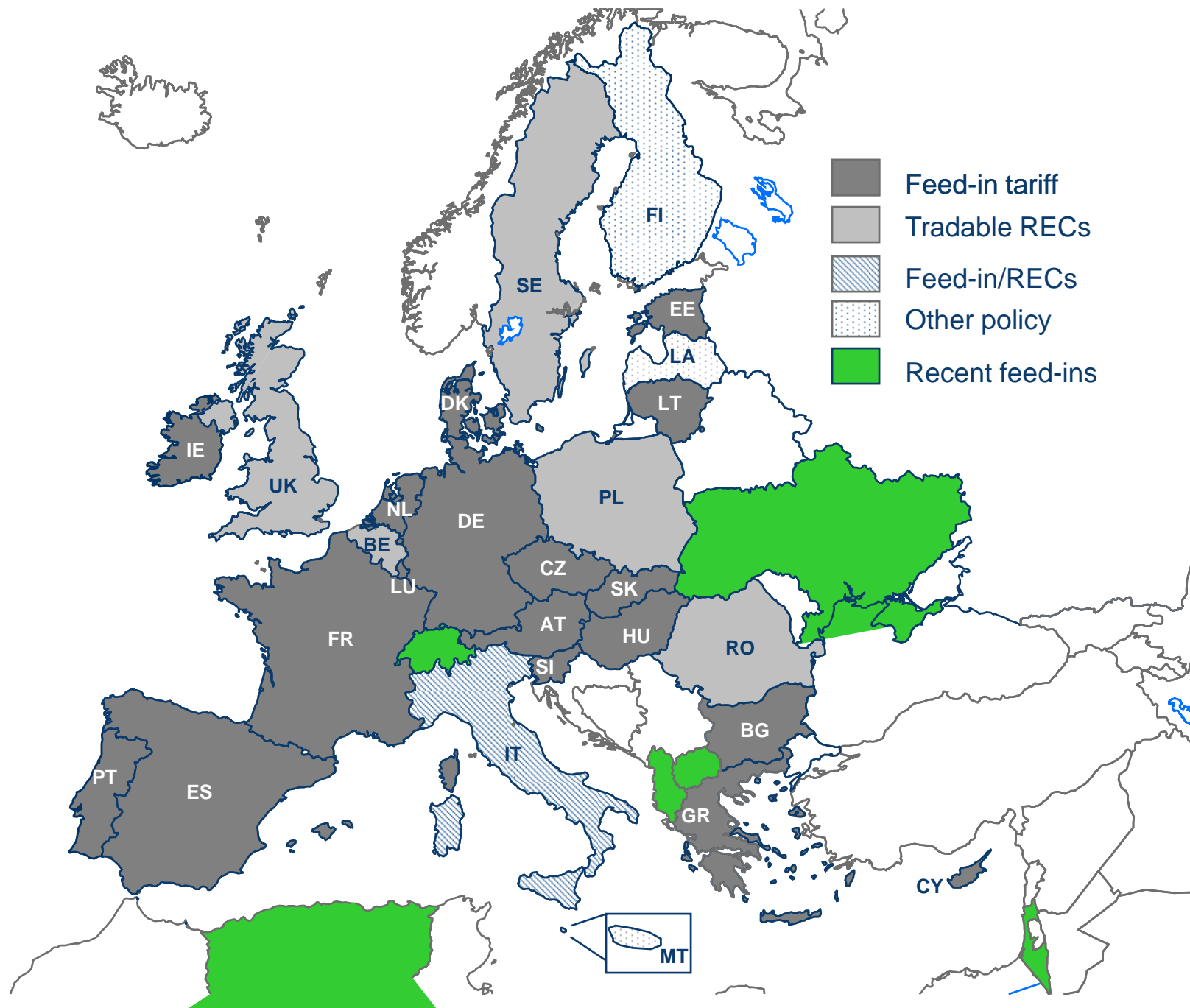
# California Feed-in Tariff Design and Policy Options:

California Energy Commission  
Feed-In Tariff Workshop  
October 1, 2008  
Sacramento, CA

Wilson Rickerson, Rickerson Energy Strategies

# Background

2007 IEPR directed the Energy Commission to explore feed-in tariffs that incorporate “features of the most successful European feed-in tariffs.”

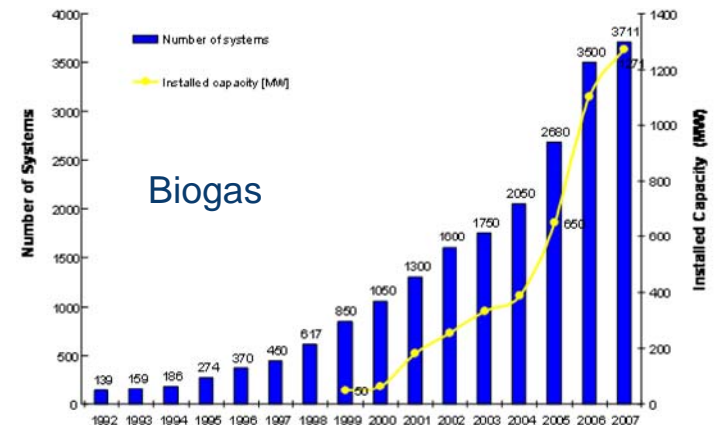
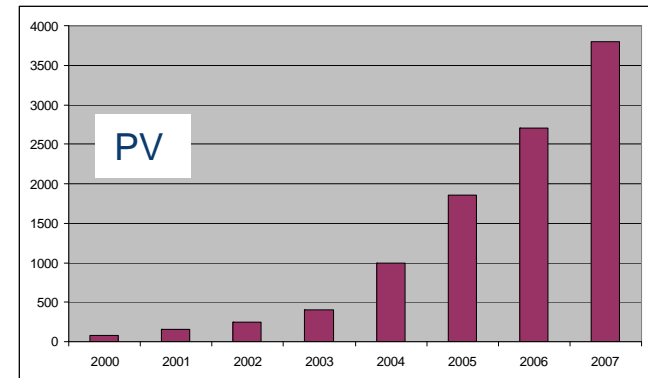
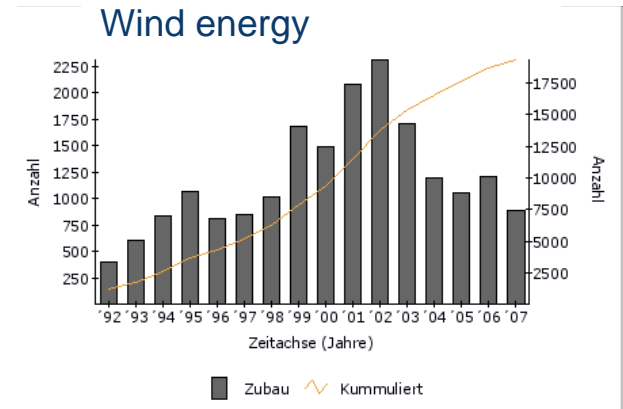


# Focus on Germany and Spain

- Germany and Spain have had the most successful policies in terms of increasing share of generation
- Both countries have used feed-in tariffs, but their feed-in tariff structures have differed significantly

# Germany: Market Growth

- 14.2% in 2007  
(target: 12.5% by 2010)
- Revised target: 25-30% by 2020
- 22,622 MW of wind  
(1,667 MW in 2007)
- 3,800 MW of PV  
(1,100 MW in 2007)
- 1,270 MW of biogas  
(doubled between 2005 and 2007)



Source: Fachverband Biogas e.V. (based on a survey of state government records; September 2007)

# Germany: Policy Evolution (1)

*Stromeinsparungsgesetz* - 1991: Price paid to generators pegged to % of retail electricity price (e.g. 65%-90%); recalculated annually

- Partially differentiated by technology and by size
  - wind/solar 90%
  - biomass/hydro < 500 kW 80%
  - biomass/hydro 500 kW < x < 5 MW 65%
- Costs redistributed within each utility territory, rather than nationally
- System size capped at 5 MW; utility portfolio share capped at 10%
- *Cons*
  - Not competitively neutral
  - Did not encourage emerging technologies
  - Price not fixed, and market momentum slowed with retail price decrease

# Germany: Policy Evolution (2)

- *Erneuerbare-Energie-Gesetz (EEG)*
- 2000: 20-year, fixed price payments
  - Differentiated by:
    - Technology
    - Size
    - Resource (for wind)
  - No system size cap and no total generation cap
  - Feed-in tariff rate declines over time according to schedule based on experience curve, and schedule reviewed every two years
  - National redistribution mechanism

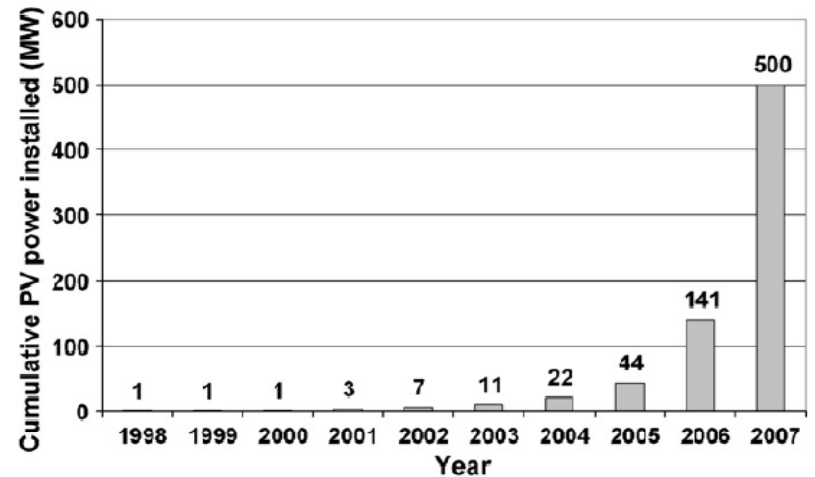
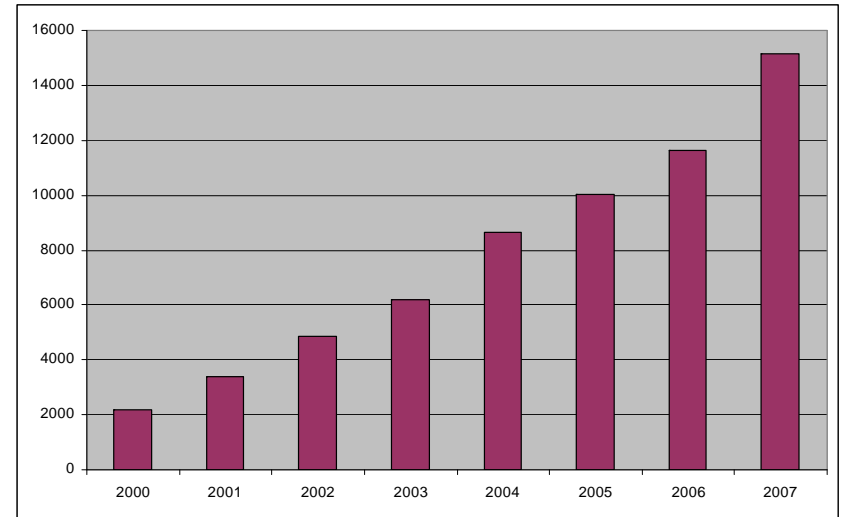
# Germany: Policy Evolution (3)

- 2004 and 2008 EEG Amendments
- 2004:
  - Adjusted payment levels for biomass, PV, and geothermal
  - Created façade-integrated PV payment and differentiated by fuels (e.g. manure) and conversion technologies (e.g. fuel cells) for biomass
- 2008:
  - Adjusted feed-in tariff digression rates
  - PV annual digression rate increased from 5%-6.5% to 8%-10% to compensate for rapid market growth



# Spain: Market Growth

- 15,145 MW wind  
(3,522 MW in 2007)
- 500 MW of PV  
(~350 MW in 2007)
- Record-setting year for wind in Europe in 2007
- 270 MW of concentrating solar thermal electric under development as of 3/08
- Biomass and hydropower markets have seen little growth



# Spain: Policy Evolution (1)

- 1998: Special Regime
  - Generators can choose feed-in tariff (similar to Germany) or a premium on top of wholesale price
  - Differentiated by technology (some by size also)
  - Incentives (both tariff and premium) contain a fixed component, and a component that is adjusted annually by government
  - Costs nationally distributed
  - Generators over 10 MW forecast generation 30 hours in advance

# Spain: Policy Evolution (2)

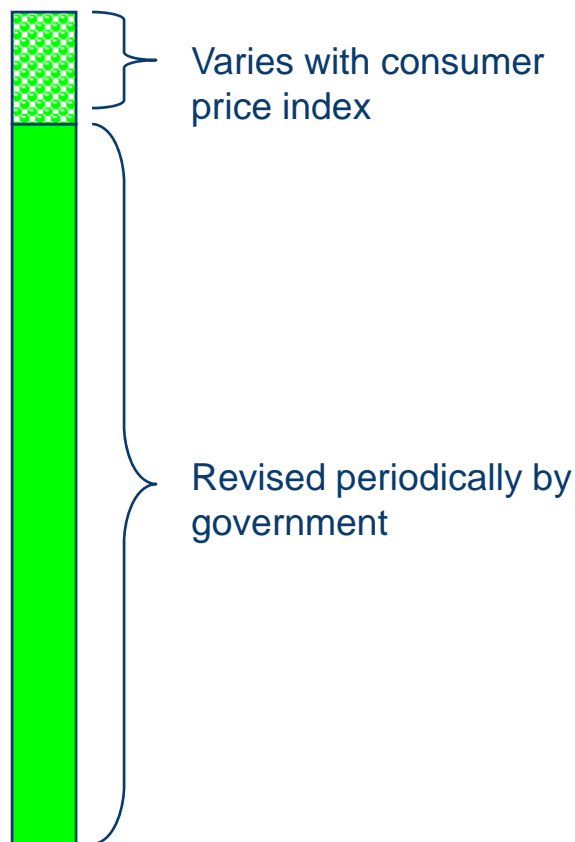
- 2004 Amendment
  - Further differentiation by size
  - Contract life set to life of system
  - Variable component of incentive adjusted annually according to annual retail prices, rather than set by the government; prices adjust for both new and existing generators
  - Capacity triggers established for specific technologies
    - 13,000 MW for wind
    - 3,200 MW for biomass
    - 2,400 MW hydro
    - 200 MW for solar thermal
    - 150 MW for PV
  - Incentive for choosing fixed premium

# Spain: Policy Evolution (3)

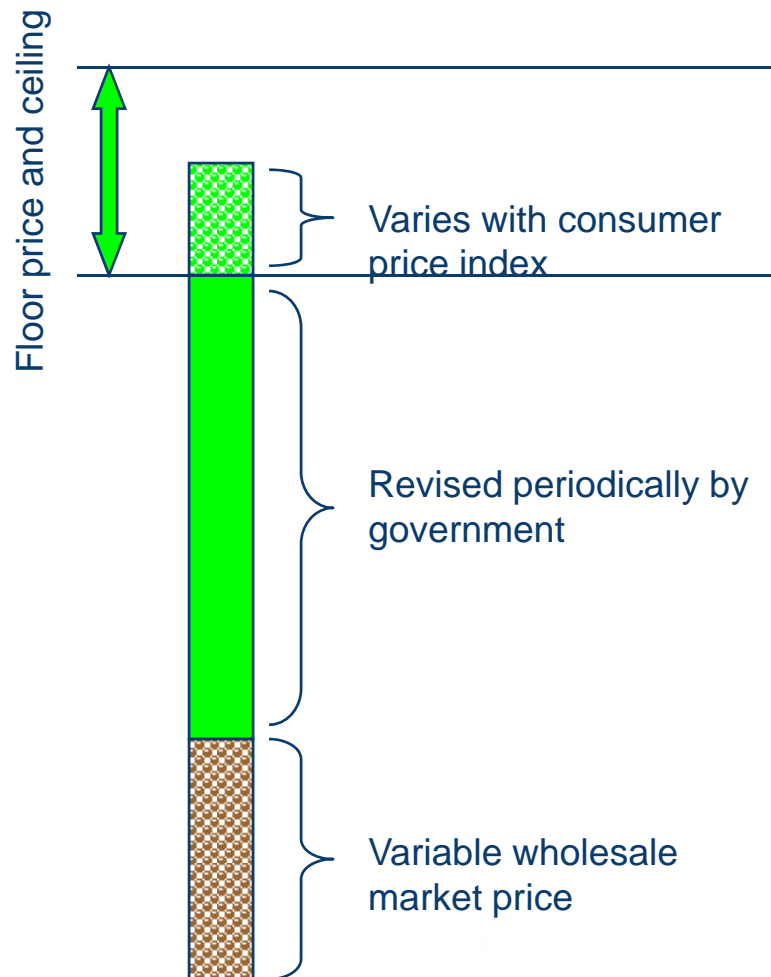
- 2007 Amendment
  - Incentive for fixed premium removed after spot market prices spike (along with policy costs)
  - Floor and ceiling value for fixed premium established
  - Annual adjustment pegged to Consumer Price Index, rather than retail cost
  - Generators bear cost of connecting to generation control center managed by system operator
- 2008 Amendment
  - Triggered by PV capacity growth
  - PV capped each year (500 MW next year)
  - PV rates lowered from .44 Euro to .34 Euro

# Spanish Feed-in Payments

## Feed-in Tariff



## Feed-in Premium



Design Issue		Germany	Spain
Contract length		20 years	Project life
Tariff structure		Fixed payment	Fixed payment or fixed premium
Incentive basis		Generation cost	Generation cost
Differentiation	Technology	Yes	Yes
	Size	Yes	Yes
	Resource quality	Yes	No
Tariff adjustment		Tariffs locked in for 20 years, applicable to a generator coming online in a particular year; for each subsequent year, the fixed 20-year rate declines according to a schedule that tracks experience curves	<ul style="list-style-type: none"> <li>• Annual tariff and premium rates pegged to CPI</li> <li>• Payment levels revised periodically by government</li> <li>• Premium payment sits atop variable wholesale electricity market price, but total remuneration is bounded by floor and ceiling prices</li> </ul>
Tariff revision		4 years	4 years, or by capacity triggers
Policy caps		None	Technology-specific capacity triggers, with grid access deposits
Forecast obligation		No	Yes
Voltage support incentive available to generators		No	Yes
Peak generation differentiation		No	Voluntary

# Lessons Learned

- Long-term, generation cost based payments can rapidly grow renewable energy markets and achieve national targets
- Technology-specific tariffs create diversity when set at appropriate levels
- Investor security is determined both by price certainty and policy certainty
- Value-based incentives may not put downward pressure on renewable energy prices
- Feed-in tariffs can suppress wholesale market prices
- Both Spain and Germany distribute policy costs nationally
- Long-term payments have been used successfully in Germany and Spain
- Implementing support for emerging resources is challenging
- Setting the correct price for biomass can be challenging



Questions?

Thank you for your attention.