Integration of Solar Electric Power: A National Review

Source: SMUD

Mike Taylor
Solar Electric Power Association

About SEPA

Solar Electric Power Association

Facilitating Utility Use and Integration of Solar Electric Power

SEPA

- Formed in 1992 as the Utility Photovoltaic Group (UPVG)
- Mission: facilitate solutions for the use and integration of solar electric power by utilities, electric service providers, and their customers
- Membership
  - Electric Utilities – 100 members
  - Industry – 100 members
  - Stakeholders – 50 members

Context

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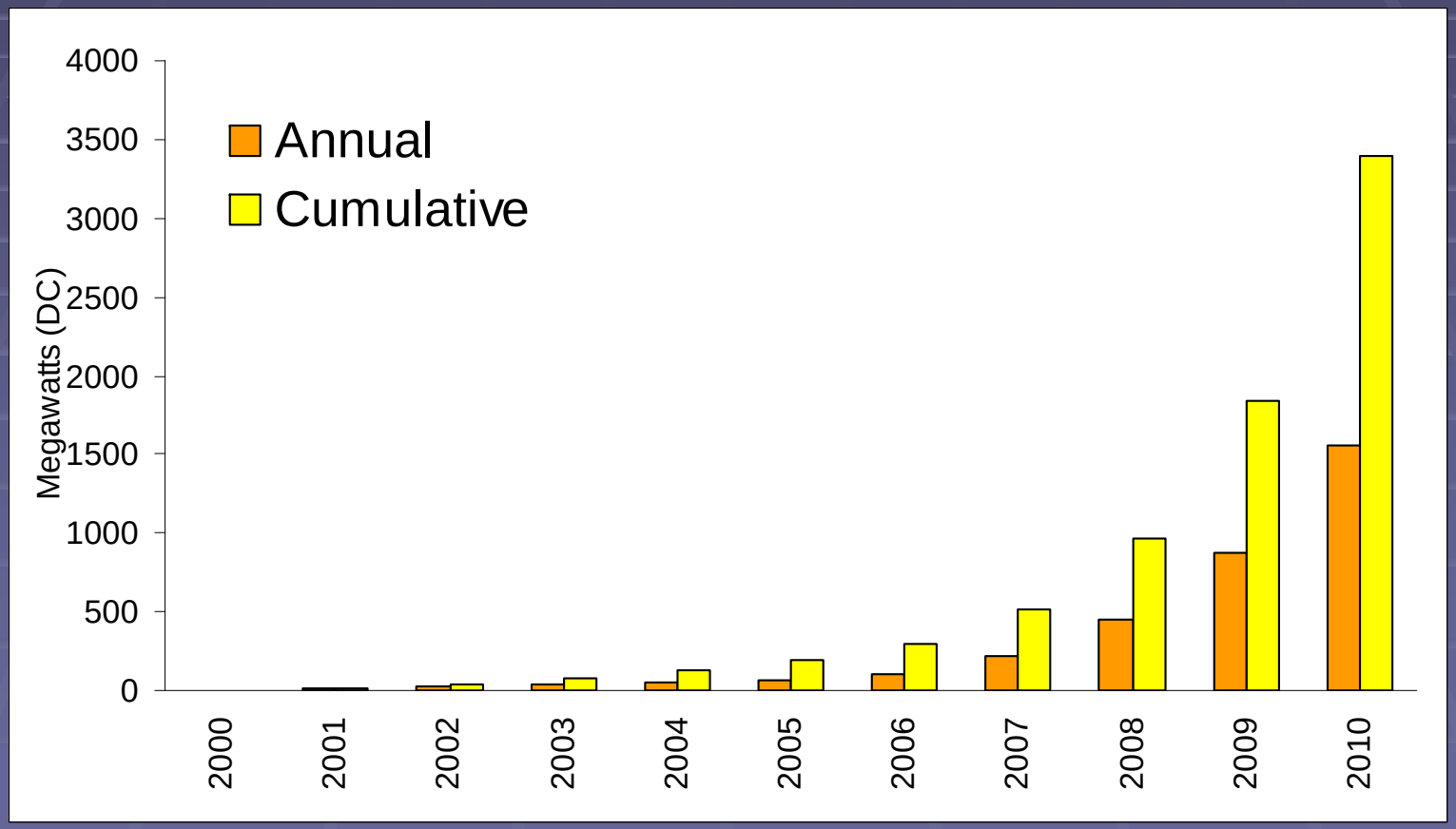
US Grid-Tied PV MW



Data: Larry Sherwood, IREC; Projections: Prometheus Institute

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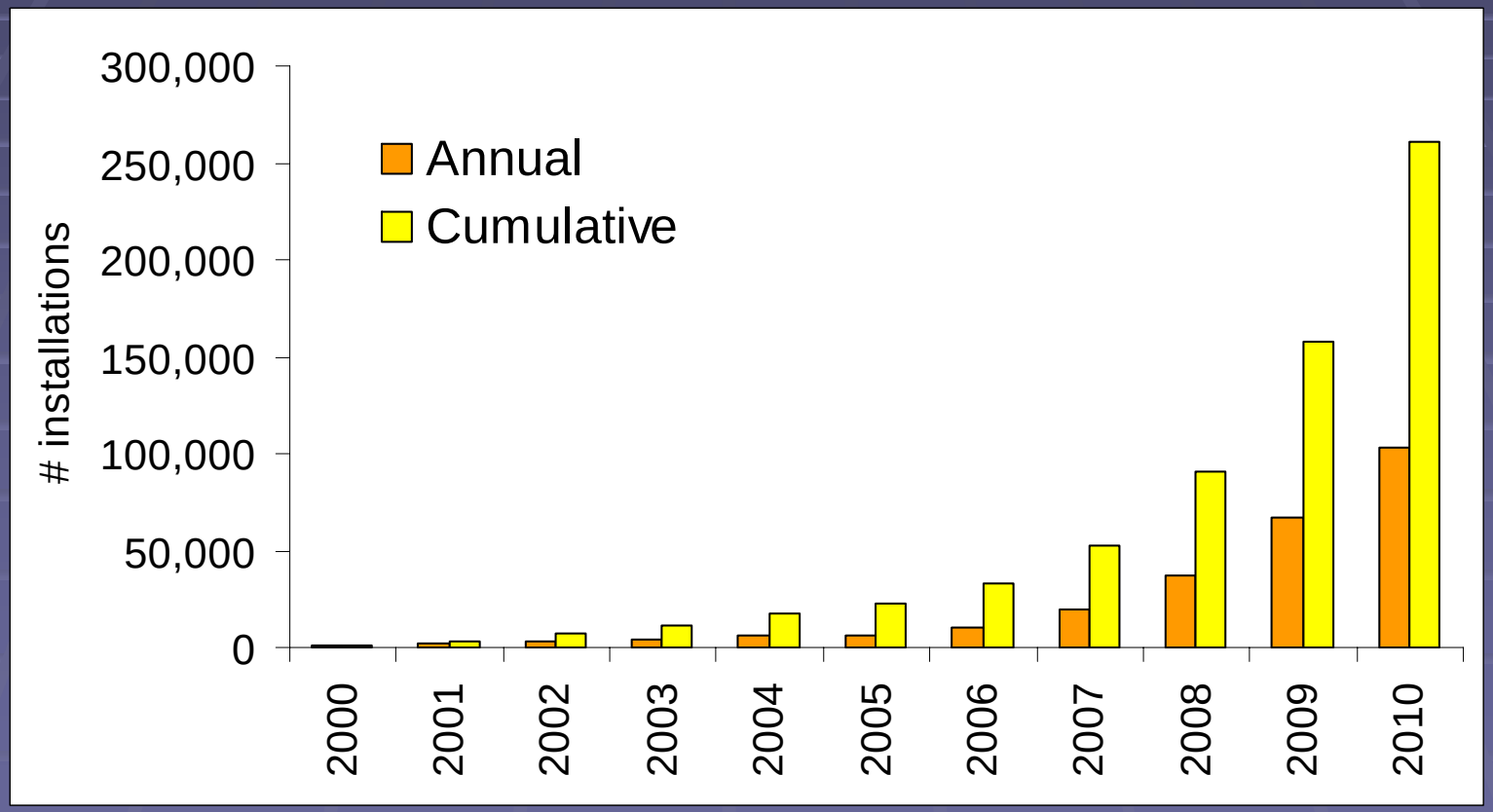
US Grid-Tied PV Installations



Data: Larry Sherwood, IREC; Projections: SEPA

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Grid-Tied PV by State

Kilowatts (DC)

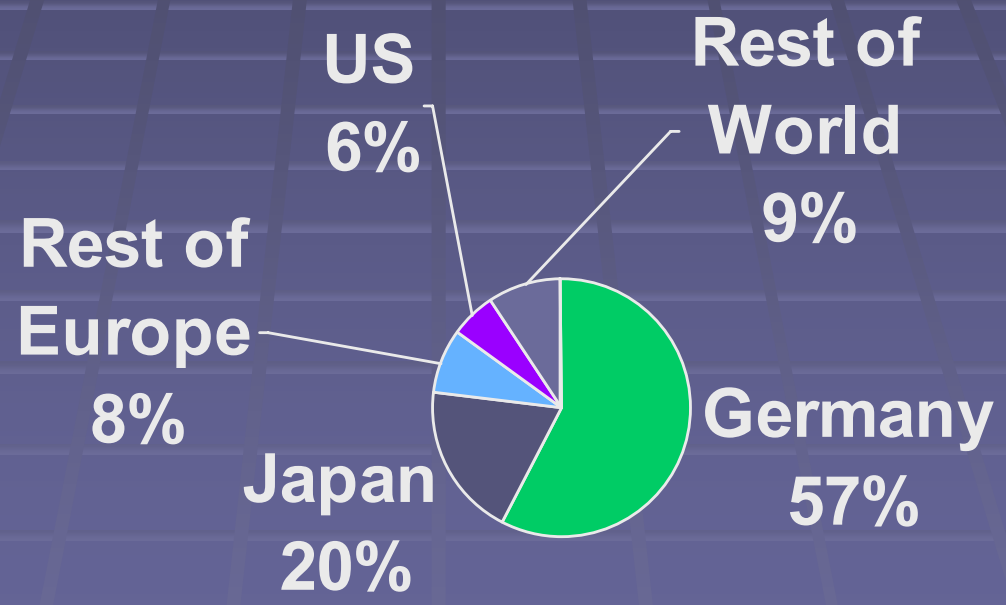
	2005	2006	% Change	% Market
CA	52,015	70,573	36%	70%
NJ	5,526	17,858	223%	18%
NY	1,418	2,709	91%	3%
NV	494	2,619	434%	3%
AZ*	1,549	2,088	35%	2%
MA	640	1,452	127%	1%
CO*	179	933	521%	<1%
TX	593	714	20%	<1%
CT	174	541	211%	<1%
OR	353	529	50%	<1%
All Others*	699	1,450	107%	1%
TOTAL	63,640	101.466	59.4%	59.4%

Source: IREC

* Includes some estimates

2006 Global PV Installations

Total: 1800 MW



2007 – Spain!

Source: Prometheus Institute

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US CSP

	MW	State	Technology	Date	Notes
SEGS	**354**	**CA**	**Trough**	**80's & 90's**	**9 phases**
Saguaro	**1**	**AZ**	**Trough**	**2006**	
Nevada Solar 1	**64**	**NV**	**Trough**	**2007**	
SCE	500	CA	Sterling	2012	350 MW expansion
SDG&E	300	CA	Sterling	2012	500 MW expansion
PG&E	554	CA	Trough	2011	1000 MW goal
SW CSP	250	AZ	TBD	2007	
NM CSP	50+	NM	TBD	TBD	
FL CSP	10	FL	CLFR Trough	TBD	
TX CSP	TBD	TX	TBD	TBD	
Total	**419** / 1664				

Bold - installed

Source: Morse & Associates, SEPA

Cost Trends

Photovoltaics (cents/kWh)

	Grid 2005	PV 2005	PV 2010	PV 2015
Residential	6-17	22-32	13-18	8-10
Commercial	5-15	16-22	9-12	6-8
Utility	4-8	13-22	10-15	5-7

Source: U.S. DOE Solar America Initiative PV Goals

Concentrating Solar Thermal (cents/kWh)

	Grid 2005	1-1000 MW	1000-2000 MW	2000-3000 MW
Utility	4-8	11-16	9-11	8-10

Source: WGA Solar Task Force Summary Report

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Maturation

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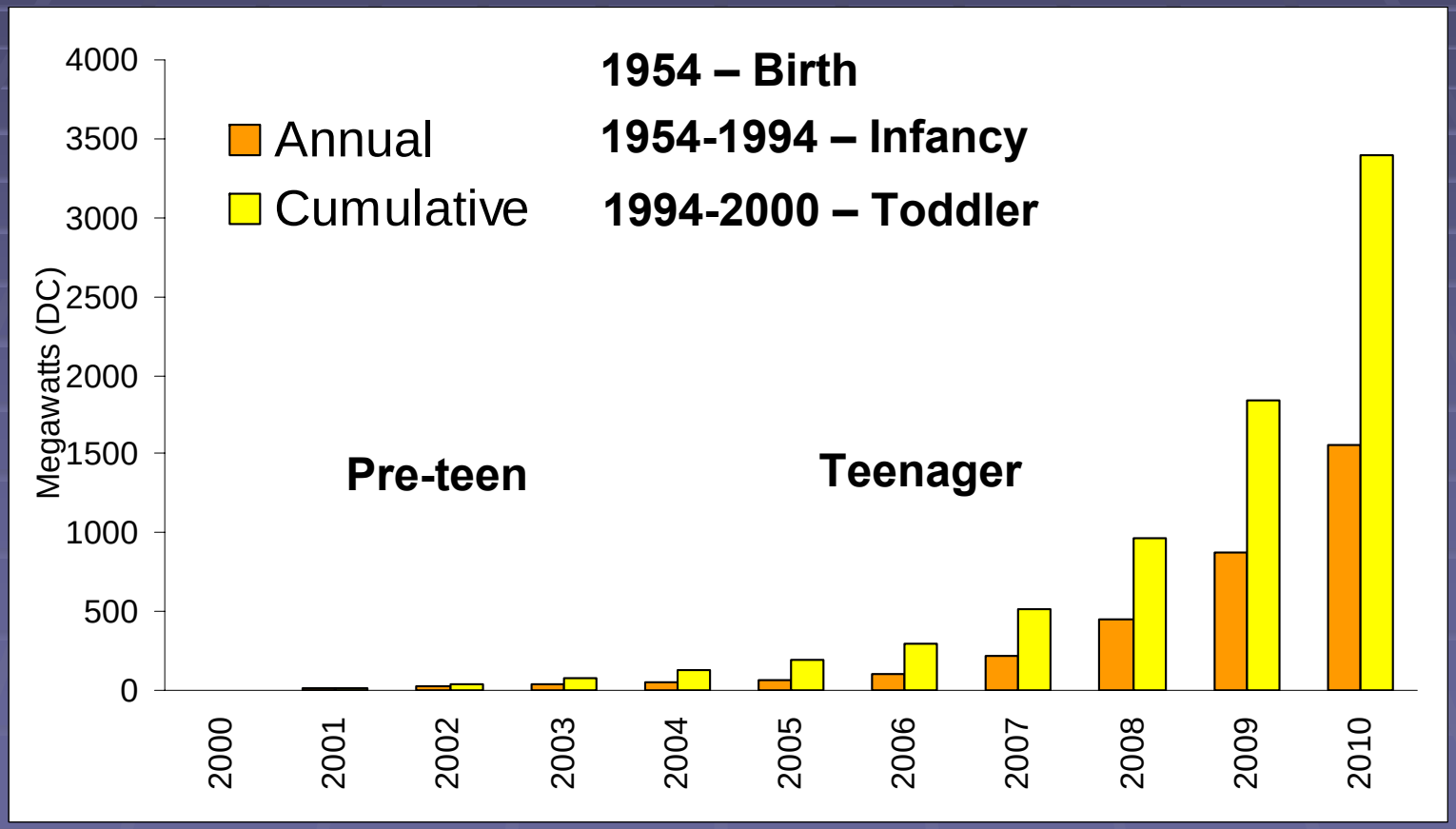
Solar Development



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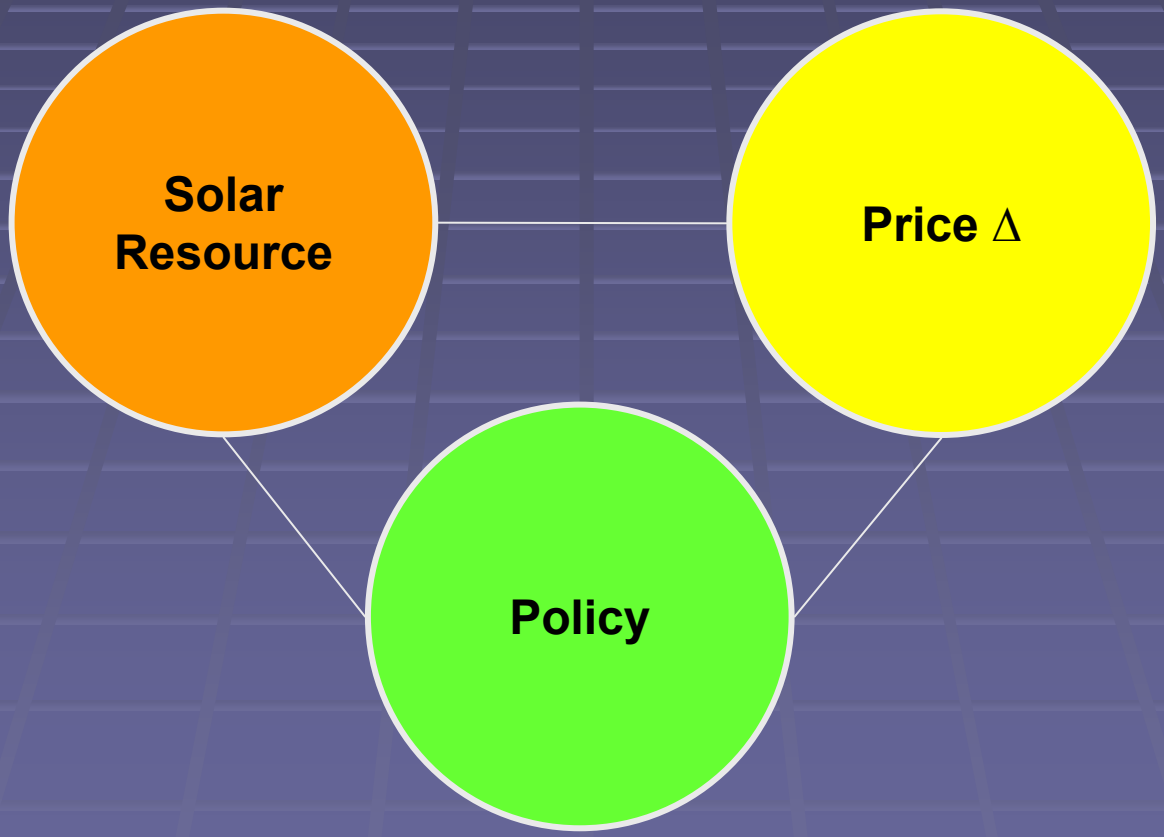
Solar Value



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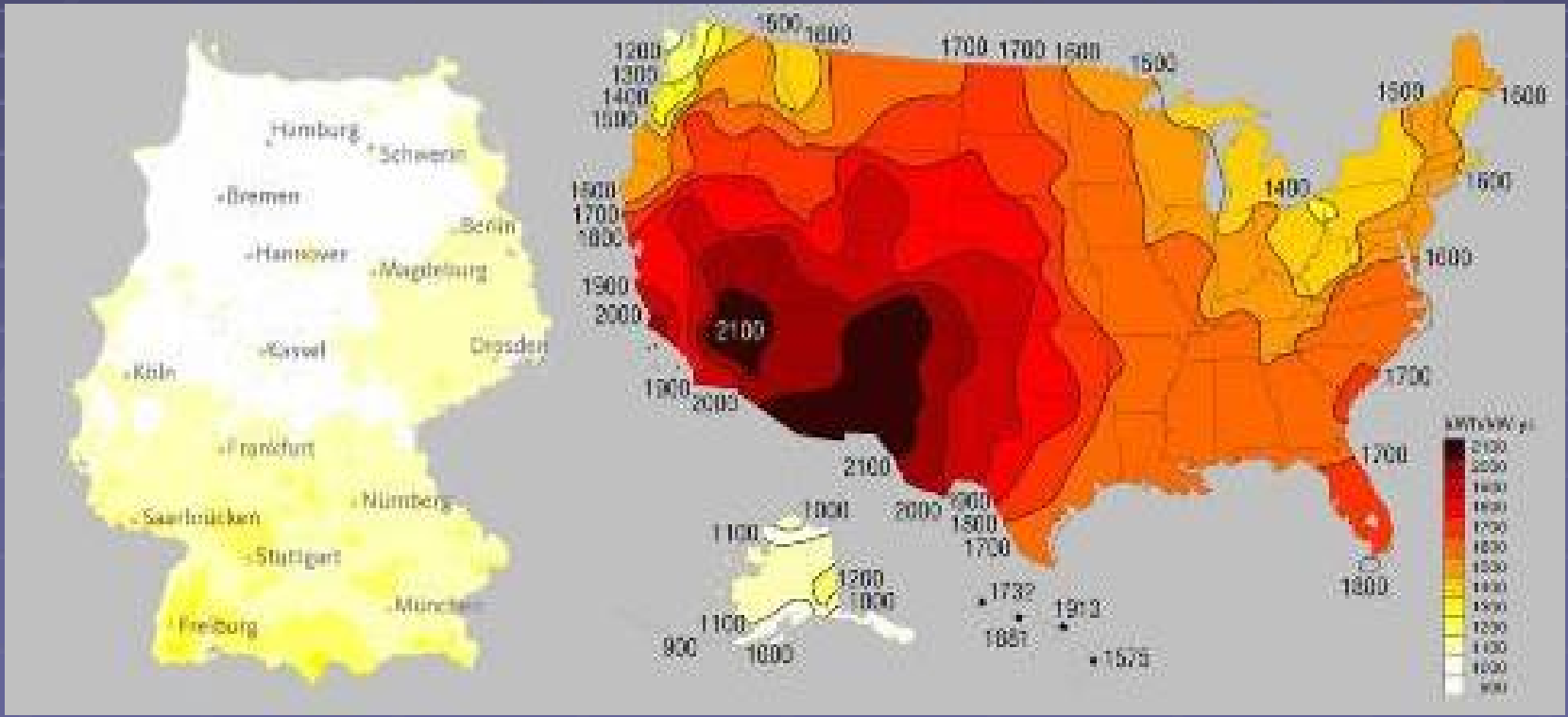
Solar Resource

1,000 MW in 2006

101 MW in 2006



Source: SEIA

Impact

"Roughly speaking, installations costs for PV in the United States are roughly twice that of Germany."

– NCI report to DOE, January 2006

Transaction Costs

Long term, consistent, and standardized policies can accelerate:

- Volume
- Competition
- Learning curves
- Manufacturing investment
- Research innovation

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Photovoltaics

Mono-crystalline silicon
Poly-crystalline silicon
Amorphous silicon
Ribbon silicon
CdTe
CIGS
CIS

Panel
BiPV
Concentrating

Number of companies
Types of companies
Location of companies

CSP

Parabolic Troughs

Dish Sterling Engines

Compact Linear Fresnel Reflectors

Heliostat Towers

Heat Transfer Fluid

Mirrors

Vacuum Tubes

Support Frames

Storage

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CSP

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CSP

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Federal

- Solar America Initiative
  - Research and Development
  - Programmatic Support
- Federal Tax Credit
- EPAct Review
  - Net Metering
  - Interconnection
- RPS / Climate Change

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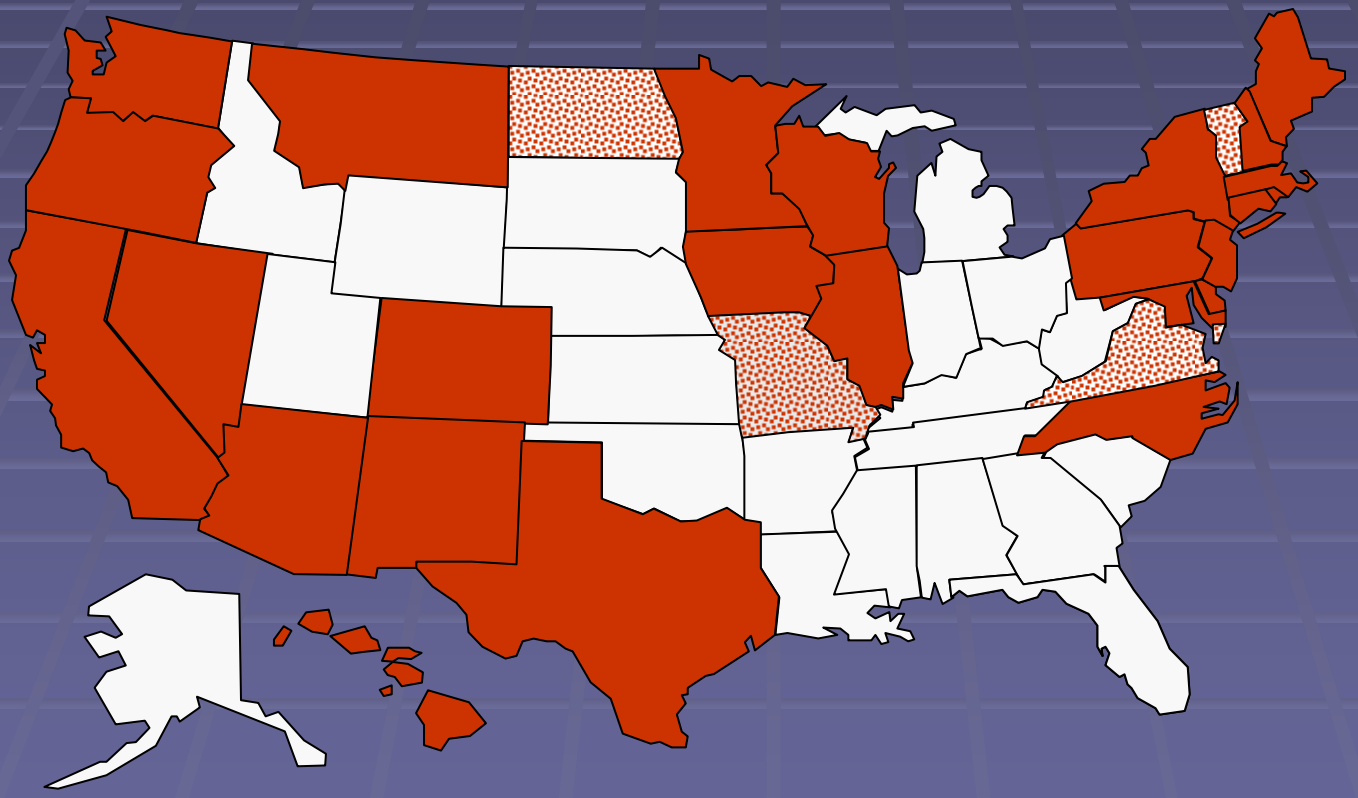
State - RPS



Data: IREC

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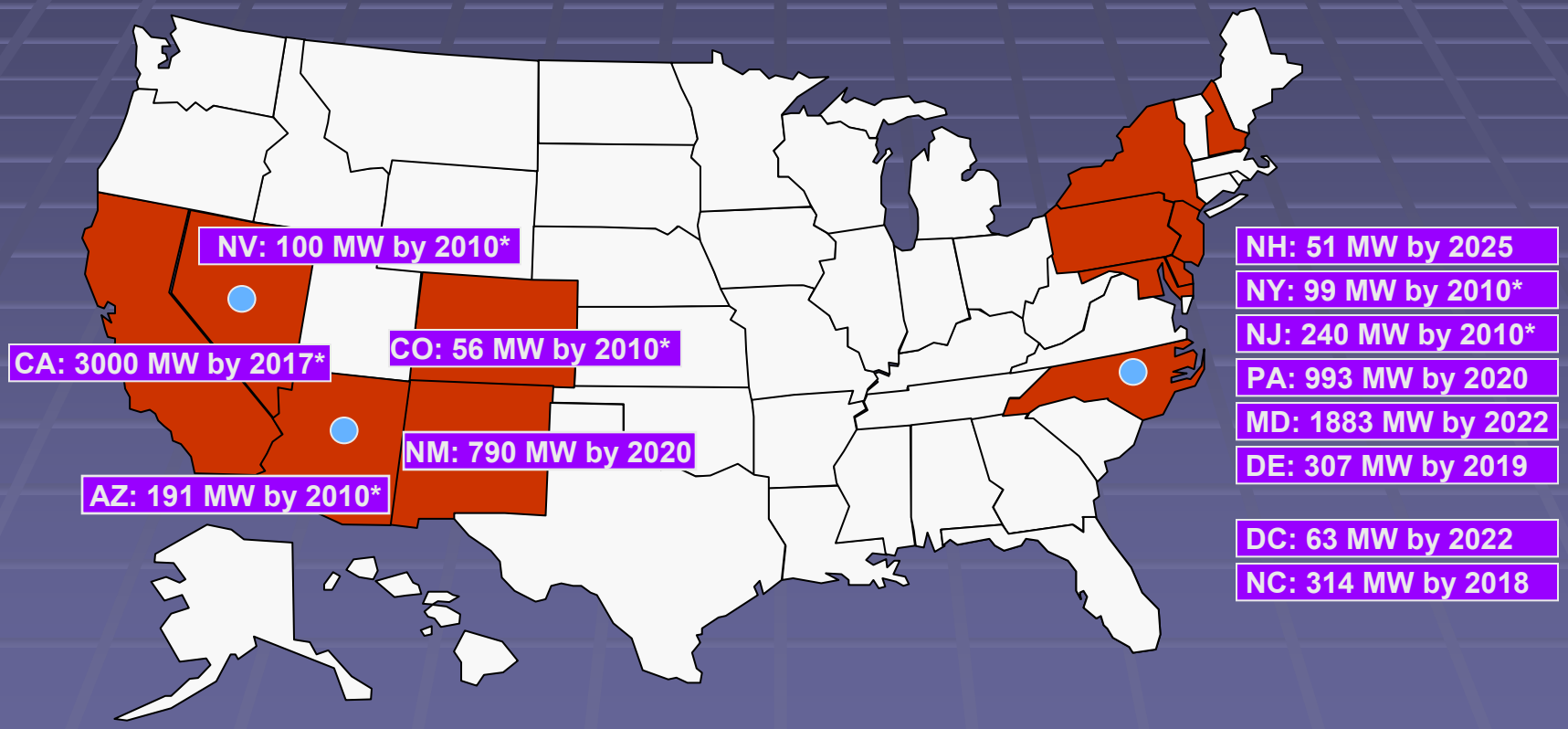
State - RPS Solar



Solar Thermal Eligible

~ 9,000 MW @ ~500,000 sites

Data: IREC, SEPA

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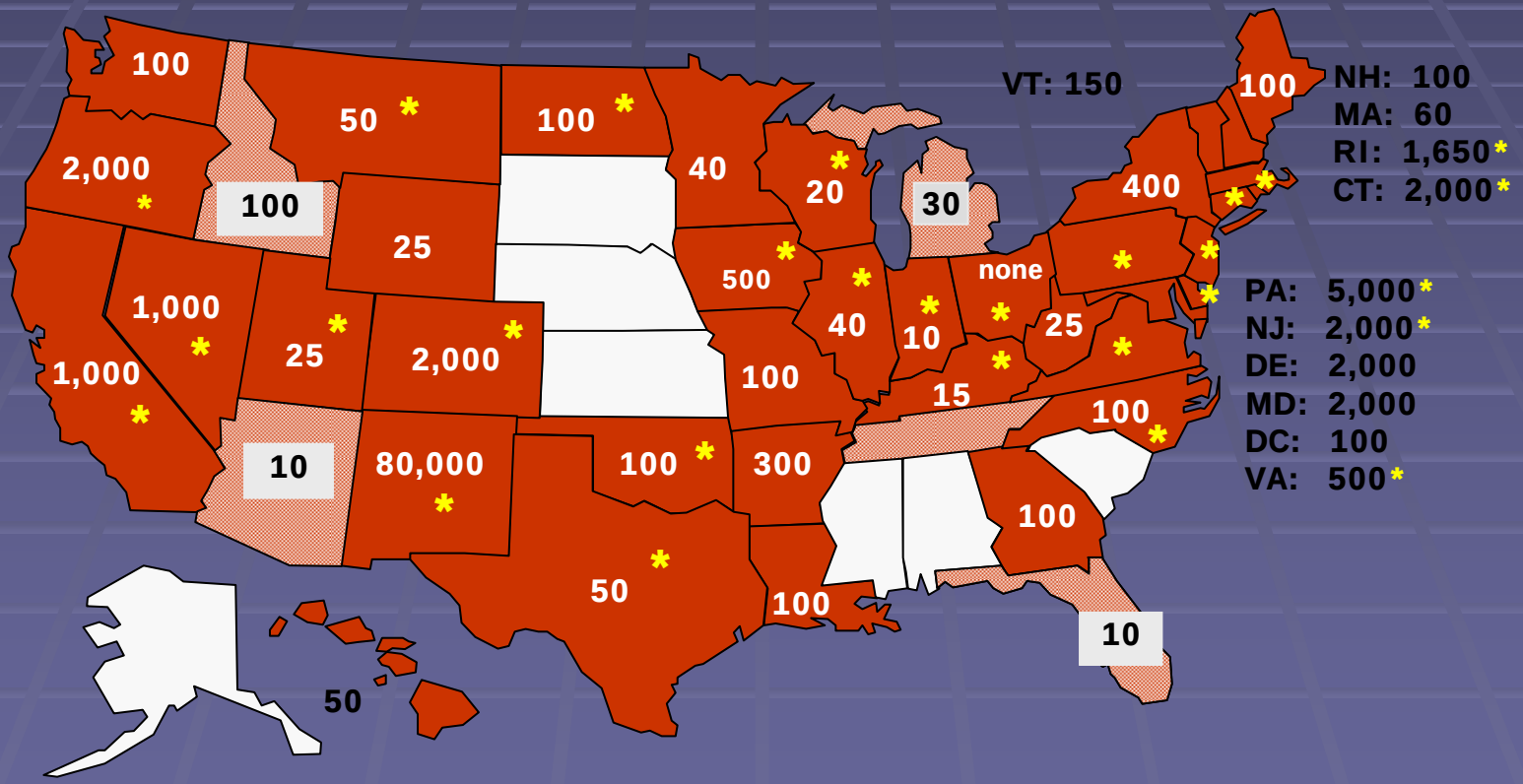
State - Net Metering



NH: 100
MA: 60
RI: 1,650*
CT: 2,000*

PA: 5,000*
NJ: 2,000*
DE: 2,000
MD: 2,000
DC: 100
VA: 500*

State-wide net metering for all utility types

* State-wide net metering for certain utility types (e.g., investor-owned utilities only)

Net metering, or equivalent, offered by one or more individual utilities

Data: IREC

State - Net Metering Survey

- > 100 kW – 25 states
- NEG + – 33 states
- Interconnection – 32 states
- RECs policies – 15 states
- No insurance – 27 states
- Small provision – 15 states
- Updated since 2005 – 21 states

Utility Interconnection Survey

- 40 utilities in 20+ states
- Residential (<10 kW) metering and interconnection survey
- 40% < 10 systems; mean 141 w/out outlier
- 91% net metering availability, 56% > 5 yrs
- 82% report no meter problems, but 58% report billing difficulties
- 13% use same meter; 45% replace with new single; 43% two meters or other

Data: SEPA

Utility Interconnection Survey

- 63% utilize IEEE1547 for interconnection
- 64% require no proof of liability insurance
- 46% use 3 or more separate forms in process
- 28% will deploy smart meters within 3 yrs
- 31% won't or don't know whether the smart meters can accommodate net metering

Data: SEPA

PV Incentives

Rebates → EPBB

Longer and Smarter

Performance
- Tariff
- PBI
- RECs

→ Steps
Sunsets
Markets

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Green Technology

- Widely available and easy to install
- Low initial cost (but 12x conventional)
- 2-3 month payback
- Reduce electric bill 5-15%

PV Markets

Singles
- Residential
- Demonstration
- Small Commercial

Cash
- Owner developed

Economies of Scale
- Subdivisions
- Commercial
- Utility

Financed
- Third-party developed

Solar Electricity vs. Solar Panels

- Power purchase agreements (PPAs)
- No capital investment by building owner
- Fixed price of electricity - insurance
- No balance sheet impact
- Maximize economies of scale and incentives

Economies of Scale

- Subdivisions – 2000+ homes
  - SMUD
  - Roseville
  - PG&E
- Megawatts
  - Nellis AFB (NV) – 15 MW
  - Xcel (CO) – 8 MW
  - Numerous – 1-2 MW each
- Kohl's, Walmart, Macy's, & Costco – 117 sites

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Utility Experience

- First Generation – Interconnection
- Second Generation – Facilitation
  - Education, Research, Demonstration, Incentives
- Third Generation – Value-added Facilitation
  - Closed-loop green pricing (TVA, WE Energies, Chelan)
  - Community net metering (SMUD)
  - Utility-owned / customer-sited (SDG&E)
  - REC loans (PSEG)
  - New home subdivisions (SMUD, Roseville)
  - CSP vs. Wind

Conclusions

What is maturity?

- Measurable market share
- Consolidation
- Technology suite
- Established practices across trades
- Performance and market drive

Increasing Wholesale Complexity &
Simplified Retail Deployment

The Future

US DOE Solar America Initiative Goal:

"Make solar cost competitive with grid power (no subsidies) by 2015*"

* Grow up

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Thank you…

Source: SMUD

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