



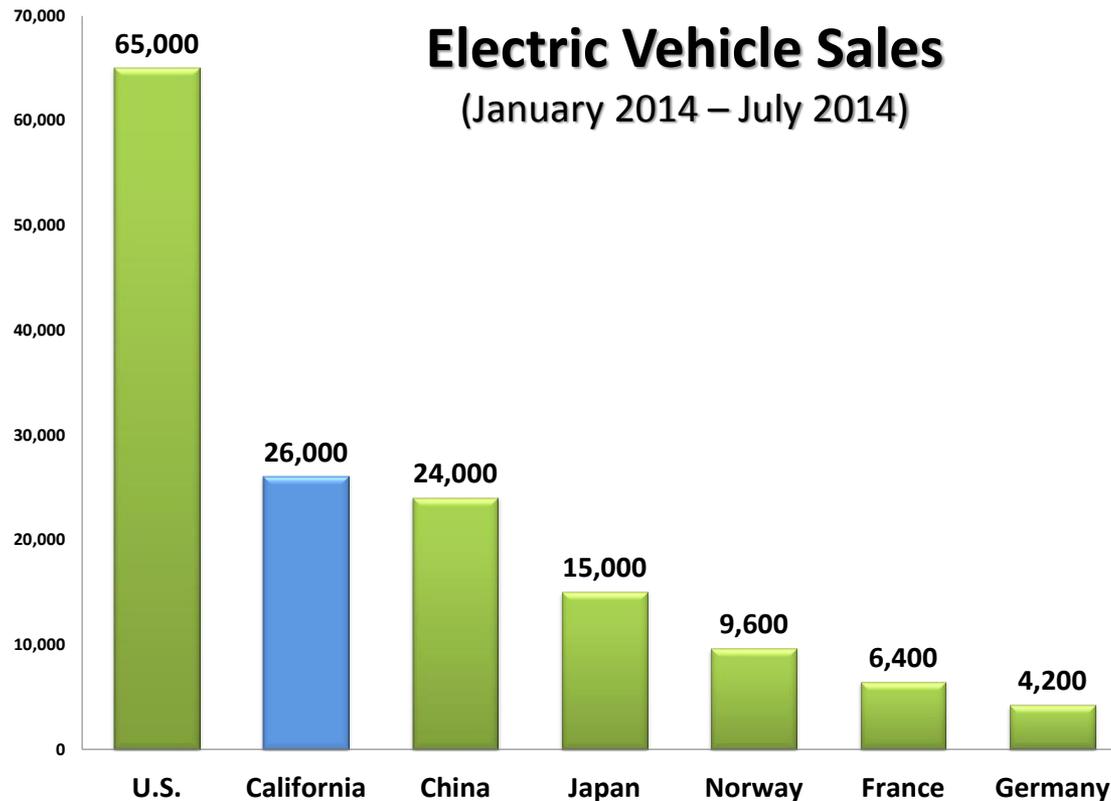
CalCharge

CalCharge Overview

ARPA-E RANGE Meeting

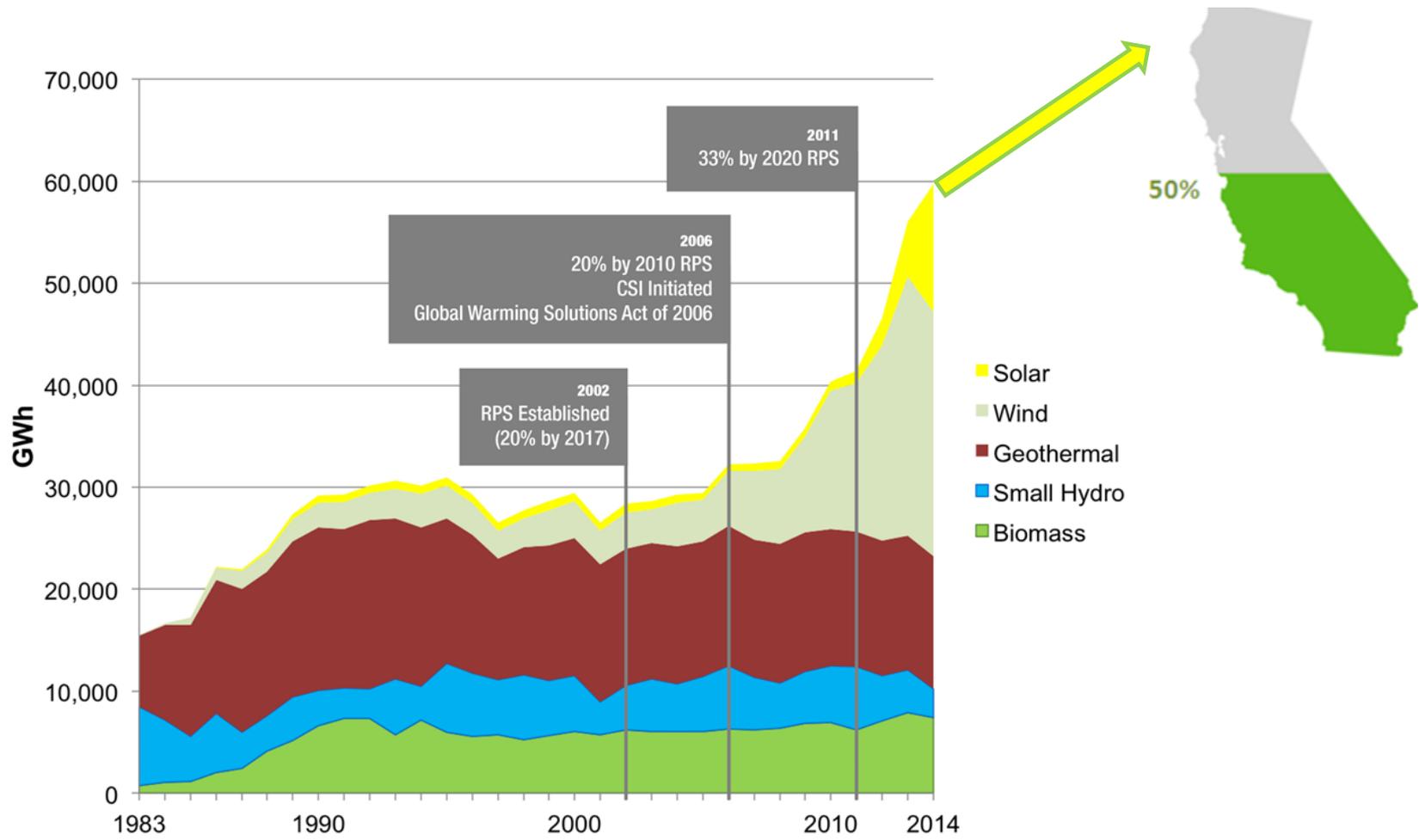
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CA: first market for EV's



47% of all EV's sold in the US are registered in CA

CA Policy Sends Market Signals



Energy storage targets across domains

CA's total target is 1325 MW by 2020 (online in 2024)

Transmission-Connected



Distribution System Connected



Customer-Connected, Behind the Meter



Target (MW)

PGE	310
SCE	210
SDGE	180
Total	700



Target (MW)

PGE	185
SCE	150
SDGE	55
Total	425



Target (MW)

PGE	85
SCE	85
SDGE	30
Total	200

CA: Critical Mass and Global Impact

- More than **130** energy storage companies and **13** academic and research institutions are located in CA
- **43%** of deployed US energy storage capacity is in California (excluding pumped hydro)
- California leads the nation in energy storage patent filings with **219** in 2013, which is more than the next four states combined
- California energy storage startups received nearly **\$73 million** in venture capital in 2013, the most of any other state
- As of 2012, California had over **2,500** jobs in the core energy storage sector*



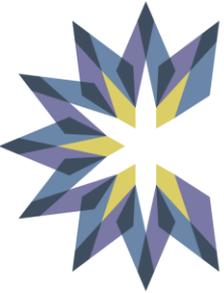
California has one the largest and most dynamic concentrations of the energy storage sector in the world.

CalCharge Origin



- 2+ years of research, 200 industry+ interviews
- A new model to accelerate energy storage: *from innovation to installation*

Current Members



CALCEF



UC San Diego



San José State UNIVERSITY



NATIONAL ACCELERATOR LABORATORY

Charter



BOSCH

General



Alveo Energy



Saratoga Energy



Program Areas

Technology Acceleration

- CRADA with Berkeley Lab
- CRADA with SLAC
- CRADA with LLNL
- IP Checkups

Pre-Commercialization Support

- Advanced Manufacturing Roadmap
- Member Driven Initiatives

Professional Development

- First MSE in Batteries with SJSU
- UC San Diego MSE (*coming soon*)
- Conferences & Seminars

Ecosystem Facilitation

- IBEW-NECA Energy Storage Standard, Certification, Development, and Training
- White papers & market analysis

CRADA with LBNL, SLAC, LLNL

- The CalCharge CRADA with the National Labs acts, in essence, as a master services agreement.
- CalCharge members will be able to access services, facilities and personnel faster with “best in class” IP and licensing terms not available to individual companies.
 - Conduct projects at any scale (\$K - \$M)
 - Divide larger projects into tiered stages, that can be conducted in rapid sequence
 - Protect background IP and all associated work product
 - First right of exclusive licensing for new IP
 - Right to protect Lab-generated project information from publication

Project Can Start in Weeks not Months

IBEW-NECA: Training & Certifications

- Developing training and certification programs for grid and distributed energy storage systems
- Will allow for easier deployment of new technologies
- Modeled after the NECA EV equipment standards (NECA 413-2012)



Advanced Manufacturing Roadmap

Can we create a Sematech for batteries?

Goal: Cost reduction and technology acceleration using a multi-pronged approach

Cut down process steps	Modernize battery manufacturing	Develop new designs
<ol style="list-style-type: none">1. Move away from slot die-casting2. “Fix formation and use energy lost3. Need to decrease process steps4. Need reliable dry process	<ol style="list-style-type: none">1. Bring “lean manufacturing” and six sigma principles to bear2. Need modular manufacturing method3. Use space 3D, rather than 2D	<ol style="list-style-type: none">1. Need sensing inside battery, go beyond voltage2. Need high power cells that also achieve high energy and high safety3. Need to develop designs that reduce losses at pack scale.
Develop process metrology	Need access to a pilot line	Develop process models
<ol style="list-style-type: none">1. Improve yield by ensuring adequate feedback loops2. Need inline diagnostics3. Ensure control over every process step	<ol style="list-style-type: none">1. Access to analytical and testing equipment2. Need standardization of materials and processes	<ol style="list-style-type: none">1. Need accurate process flow models and cost estimates2. Need believable accelerated tests battery designs on a computer

How can we help?

- **HPC4Mfg** proposal: battery manufacturing process model development (*w/LBL*)
- **Seed funding:** CalSEED program will award \$25M over 5 years (*w/CalCEF*)
- **Collaborative research:** Industry Day at LBL is May 19th
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- Sign up for newsletter: www.calcharge.org



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