1988 – 1997

The World's Largest Battery: Why the Chino BESS Failed

In 1988, Southern California Edison commissioned the largest electrochemical energy storage facility ever built at the time, a 10 MW / 40 MWh flooded lead-acid installation that proved grid-scale battery storage was technically viable, then revealed precisely why conventional lead chemistry could not sustain it.

PROJECT OVERVIEW

The Southern California Edison (SCE) Chino Battery Energy Storage Power Plant, completed in July 1988 at SCE's 220 kV Chino Substation, was the most ambitious battery energy storage demonstration project in history. Funded by SCE in partnership with the Electric Power Research Institute (EPRI) and the International Lead Zinc Research Organization (ILZRO), the facility housed 8,256 flooded lead-acid cells supplied by Exide Corporation inside two parallel 288-foot battery halls. A central converter building contained a 10 MVA, 18-pulse Gate Turn-Off (GTO) thyristor power conditioning system engineered by General Electric.

The project successfully demonstrated every targeted grid function: load-leveling, load-following, frequency regulation, VAR support, and even black-start capability. It was converted from a demonstration project to a full SCE grid resource in January 1991 — then retired quietly in June 1997 when battery replacement economics rendered continued operation unsustainable.

40 MWh	10 MW	8,256	2,000
Total Energy Storage	AC Power Rating	Lead-Acid Cells	Rated Cycle Life

ROOT CAUSES OF RETIREMENT

Four Failure Modes That Ended the Project

1. **Cycle Life Too Short for Load-Leveling Economics**
   The Exide GL-35 flooded lead-acid cells were rated for ~2,000 deep discharge cycles. Load-leveling at ~250 cycles/year meant battery replacement was required in 6-8 years.

2. **Sulfation and Irreversible Capacity Loss**
   Repeated deep cycling caused progressive lead sulfate crystal growth on plates, increasing internal resistance and permanently reducing deliverable capacity.

3. **Acid Stratification in 6-foot Tall Cells**
   Gravity caused heavy sulfuric acid to settle at the bottom of tall flooded cells. Despite air-agitation systems, stratification reduced effective active material by up to 40%.

4. **Massive Maintenance Burden**
   8,256 flooded cells required continuous watering, electrolyte agitation, hydrogen venting, and equalization charging, adding operational cost that eroded project economics.

PROJECT LIFECYCLE

From World Record to Retirement

- Aug 1986 — **Project Initiated by SCE**
  EPRI, ILZRO, GE, Exide engaged as partners.
- July 1988 — **Facility Completed**
  8,256 cells, 10 MVA GTO inverter. 70-72% efficiency.
- 1988-1990 — **Demonstration Program**
  All objectives met: load-leveling, VAR, black-start.
- Jan 1991 — **Full Grid Resource**
  Integrated into SCE dispatch for load management.
- 1991-1997 — **Capacity Degradation**
  Sulfation, corrosion, stratification eroded capacity.
- June 1997 — **Facility Retired**
  Replacement cost exceeded economics. Decommissioned.

> "The Chino facility proved that utility-scale battery storage could do everything a power plant could do — and revealed exactly which electrochemical limitations had to be solved before it could do so economically.
>
> — EPRI / Sandia National Laboratories, post-operational assessment

GreenSeal® Bipolar Lead Batteries to the Rescue

TECHNOLOGY REFRESH

Every root cause of the Chino facility's retirement can be traced to the inherent limitations of conventional flooded lead-acid cell construction. ABC's GreenSeal® bipolar lead battery architecture directly addresses each of these failure modes.

CEES™ BatteryBarn — Multi-megawatt bipolar lead battery installation | Advanced Battery Concepts, Clare, MI

THE CORE INSIGHT

The Chino project did not fail because batteries cannot do what a grid needs them to do. It failed because conventional flooded lead-acid construction amplified every known degradation mechanism at utility scale. Bipolar lead battery architecture eliminates or dramatically reduces each of these structural weaknesses without changing the fundamental chemistry.

HOW BIPOLAR TECHNOLOGY RESPONDS

Each Failure Mode — Addressed

7,500+ Cycle Life
Bipolar architecture eliminates bulky intercell connectors. 7,500 cycle target, 3.75x the Chino cells.

Eliminates Acid Stratification
VRLA AGM electrolyte is immobilized. No liquid to stratify. No air agitation systems required. Batteries are oriented horizontally to avoid gravity's pull.

Carbon Enhancement Suppresses Sulfation
Lead-carbon negative plates dramatically reduce irreversible sulfate crystal accumulation during cycling.

Sealed VRLA — Zero Maintenance
No water addition, no equalization charging, no hydrogen venting. The entire maintenance burden is removed.

30-40% Lower Weight, Higher Density
Power density: 900-1,400 W/kg vs. 200-400 W/kg for flooded designs. Smaller footprint per kWh.

TECHNOLOGY COMPARISON

1988 Chino vs. Advanced Bipolar

Parameter	Chino 1988	Bipolar 2026
Cycle Life	~2,000	7,500
Service Life	~8 years	20-25 years
Stratification	High risk	Eliminated
Sulfation	Primary failure	Carbon-suppressed
Maintenance	High (watering)	Near-zero
Energy Density	~35 Wh/kg	~65-70 Wh/kg
Power Density	200-400 W/kg	900-1,400 W/kg
Efficiency	70-72%	80-85%
Recyclable	99%	99%+

The Chino BESS proved — definitively — that utility-scale lead battery storage can deliver every grid service a modern power system needs. Advanced bipolar lead battery technology resolves every failure mode.

DOE COST TARGET

$35 / kWh