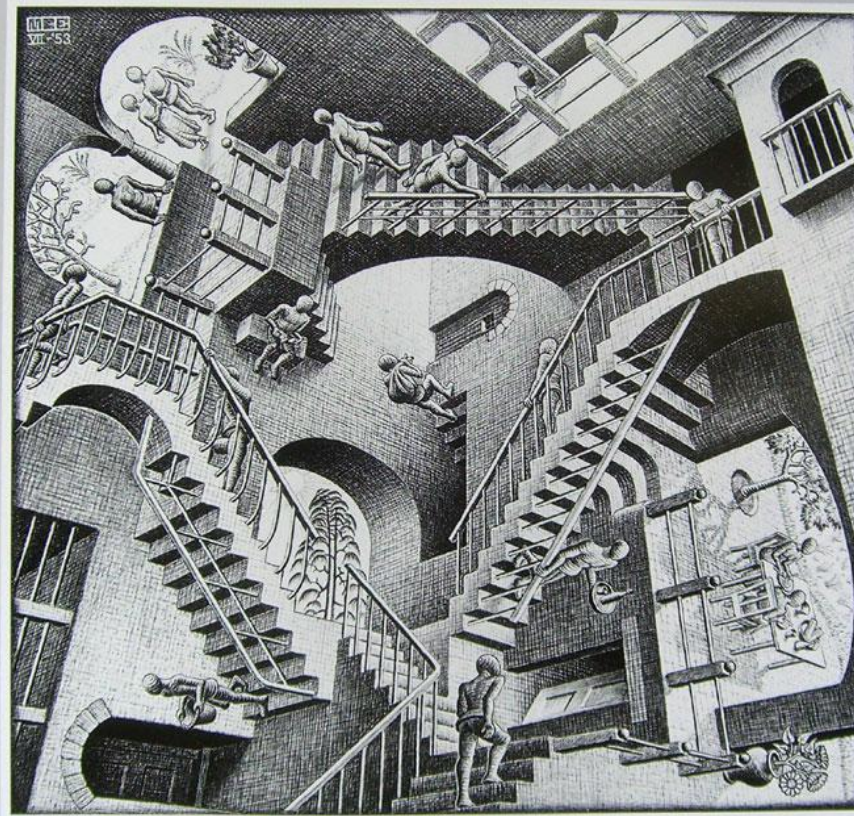


Problem, Solution, Whose
Perspective?

Perspective Matters

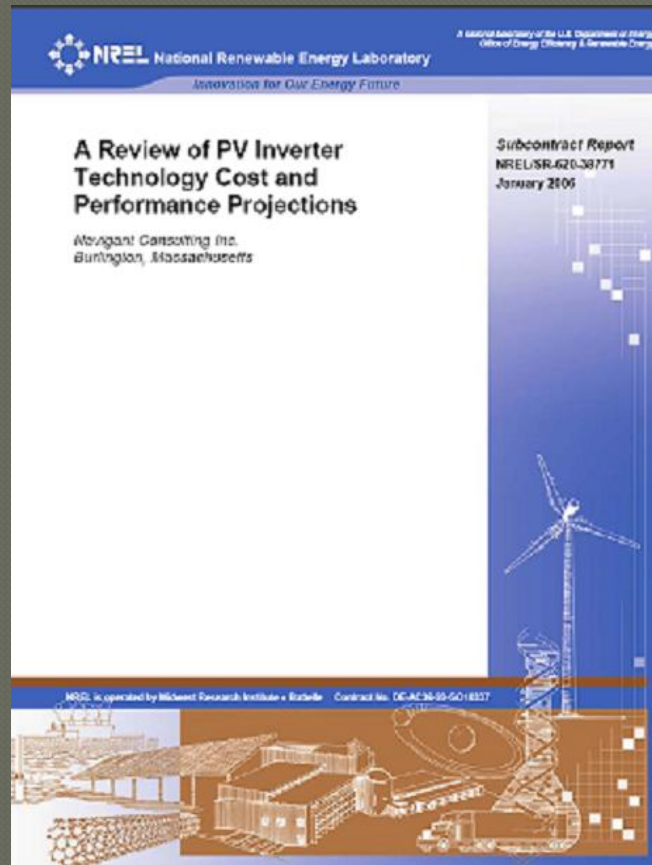
Where do Solutions Come From?



M. C. E. S. C. H. E. R.®

M.C.E.

NREL Perspective on Inverters



- MTBF of Inverters is 5 to 10 Years
- Longer Warranties Controversial
- Price in 2020, \$.38 to \$.65 per watt, DOE goal \$.30 per watt
- Present Architectures a Dead End

Inverter Manufacturers' Perspectives

- Fronius, Head of Sales: “ A 20-year lifetime is can't be achieved”
- Xantrax, Managing Director: “Why make inverters with a longer life...customer is better off replacing the inverter every 10 years or so anyway?”
- SMA, President: “Why focus on higher reliability? Our customers worry only about first, cost” .

ARPA-e Perspective, SunShot

- To get to \$1.00 per watt for solar we need:
 - \$.10 per watt inverters
 - \$.20 per watt microinverters
 - 30 year lifetimes
 - Less than 10 components per microinverter
 - Hot pluggable for fast replacement

Soquel Energy Perspective

- ◉ Soquel Energy Sunlite™ microinverter
COG & labor = \$.09 per watt
- ◉ 30 year lifetime
- ◉ Heat management, no component ever gets hotter than 37 deg C
- ◉ No unreliable capacitors for energy storage, energy stored in magnetic field

Evolution of a Solution Path

- ◉ NREL: What we have is not good enough
- ◉ APAR-e: Push for a better solution
- ◉ Manufacturers: We still have no incentive to do better
- ◉ Soquel Energy: Solve the big problems with advanced technology, but solutions won't come from the existing industry

Solar Energy, Utility Perspective

(The Grid Reliability Issue)

- ◉ Mandated Alternative Energy Requirement 33% by 2020 in California
- ◉ AB2514 requires 10% energy backup
- ◉ Business as usual, centralized generation and distribution
- ◉ PPAs, distributed generation, home solar are competitors, threats
- ◉ What, me worry?

2011 RETECH Conference, Focus on Utilities

Six Days of Presentations Without a
Single Agenda Item on the Stability of
the Utility Grid

Wed. September 21 Morning	Wed. September 21 Mid Morning	Wed. September 21 Afternoon	Thur. September 22 Morning	Thur. September 22 Mid Morning	Thur. September 22 Afternoon
8:30 am - 10:00 am	11:00 am -12:30 pm	2:00 pm -3:30 pm	8:30 am -10:00 am	11:00 am -12:30 pm	1:30 pm -3:30 pm
Track A: Strategic Industry Market Trends and Issues in Policy Public Affairs					
Session A1 - Energy Outlook	Session A2 - Global Markets and Competition	Session A3 - Business Opportunities in Developing Countries	Session A4 - Strategic Collaboration - Natural Gas and Renewable Energy	Session A5 - Renewable Energy Ecosystem Collaboration For Achieving Operational Excellence	Session A6 - Strategies for the Adoption of Renewable Energy
Track B: US Federal/State/Local Policies, Programs and Perspectives on Renewable Energy					
Session B1 - Update on Federal Regulations and Programs	Session B2 - State Policies Cross-Cutting Issues	Session B3 - State Reports	Session B4 - U.S. Department of Energy Technology Programs	Session B5 - Department of Defense Programs	B6: National and Energy Security in the Americas Panel
Track C: Renewable Energy Power Generation Technology					
Session C1 - Solar Thermal Electric	Session C2 - Wind	Session C3 - Solar PV	Session C4 - Geothermal	Session C5 - Hydro/Tidal/Wave	Session C6 - Biomass Power and Thermal; Biogas, and Waste to Energy
Track D: Innovations in Fuels, Transportation, Efficiency, and Technology					
Session D1 - Conventional Biofuels Application	Session D2 - Advanced Fuels	Session D3 - Clean Transportation	Session D4 - Advanced Materials and Chemicals	Session D5 - Energy Efficiency and Green Buildings	Session D6 - Smart Grid and Information Technology
Track E: Transmission and Grid Integration					
Session E1 - Transmission and Grid Integration	Session E2 - Storage	Session E3 - Utility Perspective on RE Integration	Session E4 - Siting, Permitting and Environmental Issues	Session E5 - Market Demand and Consumer Value	Session E6 - Renewable Energy and The Smart Grid
Track F: Renewable Energy Investment and Financing					
Session F1 - Government Finance	Session F2 - Small Project/ Innovative Financing	Session F3 - Project Finance: Source and Structures	Session F4 - Where is VC/PE Going?	Session F5 - M&A, IPOs and Strategic Transaction	Session F6 - International Development
Track G: International Trade in Renewable Energy					
Session G1 - Global Renewable Energy Best Practices Driving Industry	Session G2 - Opportunities for Foreign Companies Within the Regions of the USA	Session G3 - Opportunities for US Companies in Overseas Markets	Session G4 - Excellence in International Business Partnering		

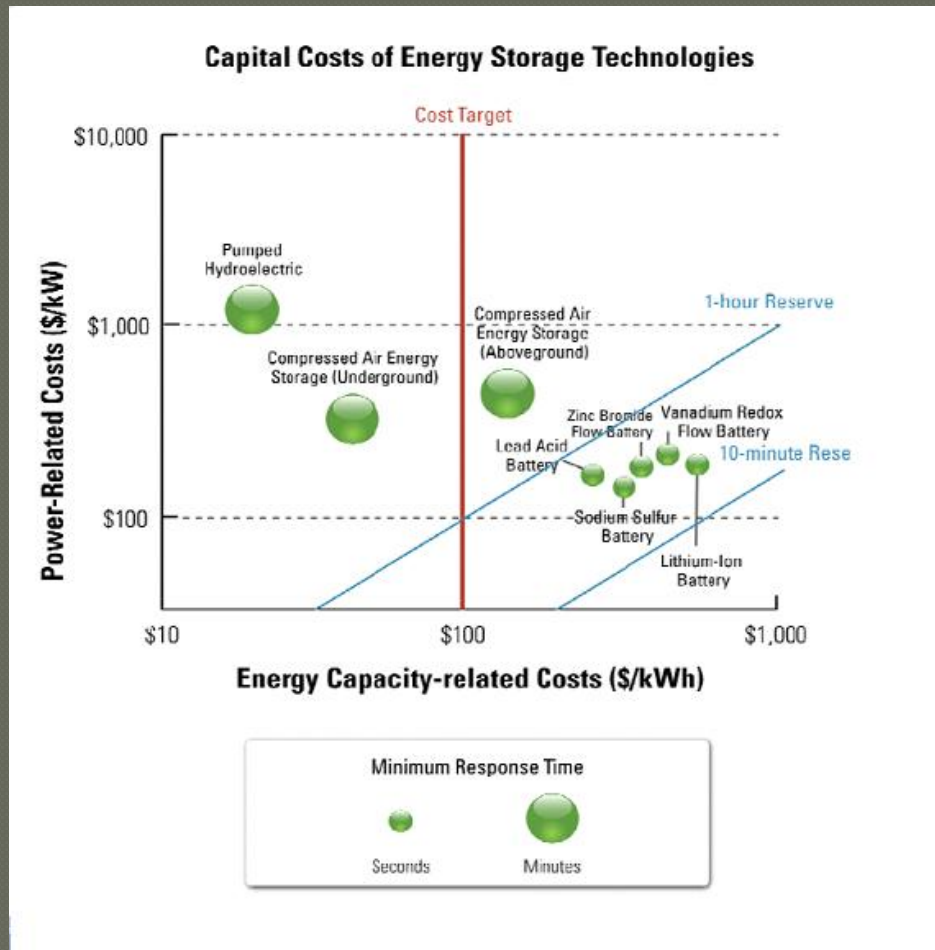
California's Perspective

- ◉ Grid Becoming More Unstable
- ◉ ISO Resource limited
- ◉ No enforcement or development authority, but ISO has the responsibility for grid stability
- ◉ California Energy Commission Technical Staff “ We hear about that problem in every meeting we attend, but we don't have a solution yet” .

Solar User's Perspective on Grid Stability

- ⦿ Though diminishing incentives to invest in solar, PPAs make solar attractive and affordable
- ⦿ Users may want to contribute to solutions, but lack opportunities
- ⦿ Not my problem

ARPAe's Perspective on Solution to Alternative Energy's Intermittancy



Soquel Energy's Solution to Solar Power Induced Grid Transients

- ◉ Add Energy Management Units (EMUs) to Commercial, Industrial, and residential solar
- ◉ EMU are Grid storage at 20% of bulk energy storage
- ◉ Utilities or ISOs have 100% control
- ◉ User benefit from attractive FIT
- ◉ Then users part of solution and no solar transients

Solutions Come from Vision, Opportunity, Incentive.....and Perspective

- Academia can have a powerful influence on the solution path
- Cross pollination of economic, social, and technological ideas create rich perspectives
- “If you come to a fork in the road, take it.”—Yogi Berra (Or maybe there’s more than one good idea, some solutions can’t wait for a technological silver bullet)