

Rewiring the Northwest's Energy Infrastructure: An Integrated Vision and New Investment Strategy

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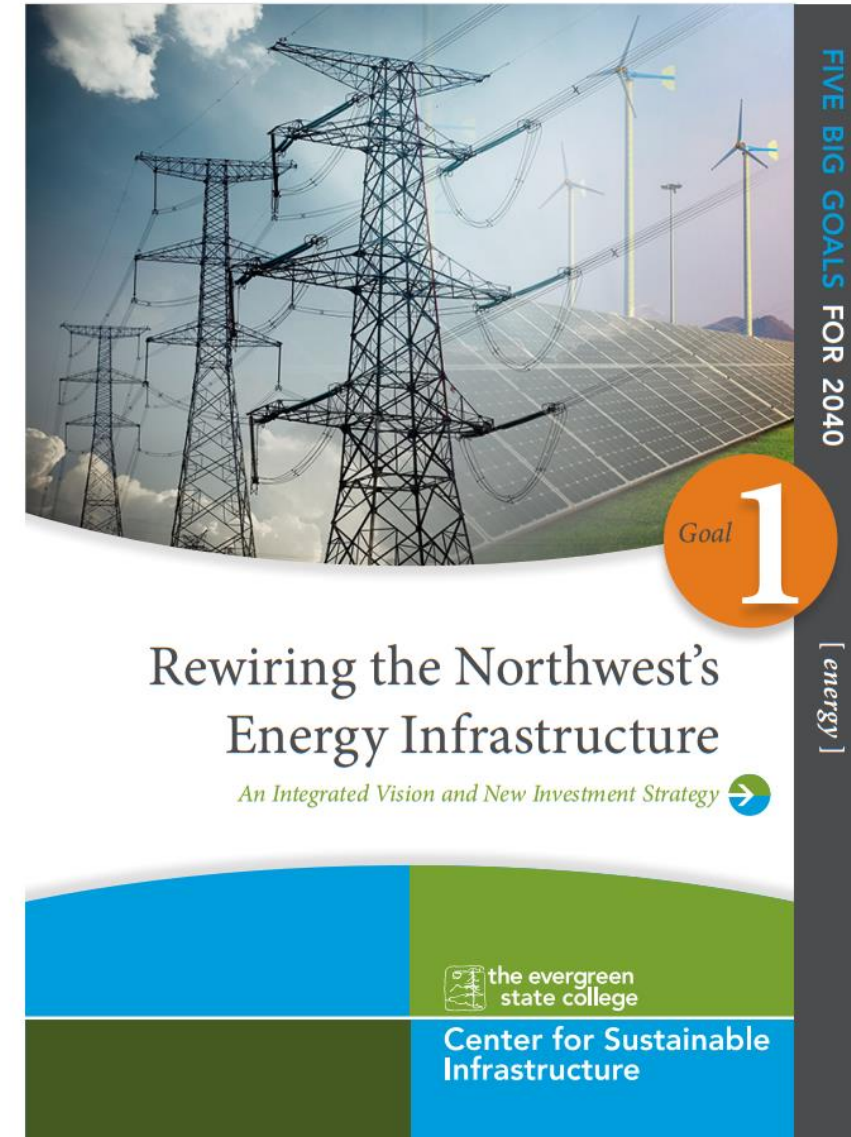


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Rewiring the NW's Energy Infrastructure: *Key Findings*

- ▶ Take the Long View: *What kind of energy system do we want in 2040?*
- ▶ The Coming Tech Revolution - *no turning back*
- ▶ Rethinking the Utility Business Model
- ▶ Redesigning State Policy



CSI Inaugural Report

- ▶ Rethink our infrastructure investment strategies to get better outcomes.
- ▶ Interviewed 70 thought leaders from WA, OR, and BC.
- ▶ Spans energy, transportation, water, and waste sectors.



Infrastructure Crisis,
Sustainable Solutions:

Rethinking Our Infrastructure Investment Strategies →



The Multi-Billion Dollar Question:

How do we get *smarter* about how
we'll invest this money?



Key Innovation Principles for Sustainable Infrastructure

- ▶ Go for the Triple Crown: *Affordable, Resilient, and Sustainable*
- ▶ Encourage Silo-Busting
- ▶ Build a Better Business Case
- ▶ Choose for a Changing World
- ▶ Get Smart
- ▶ Build Community Prosperity

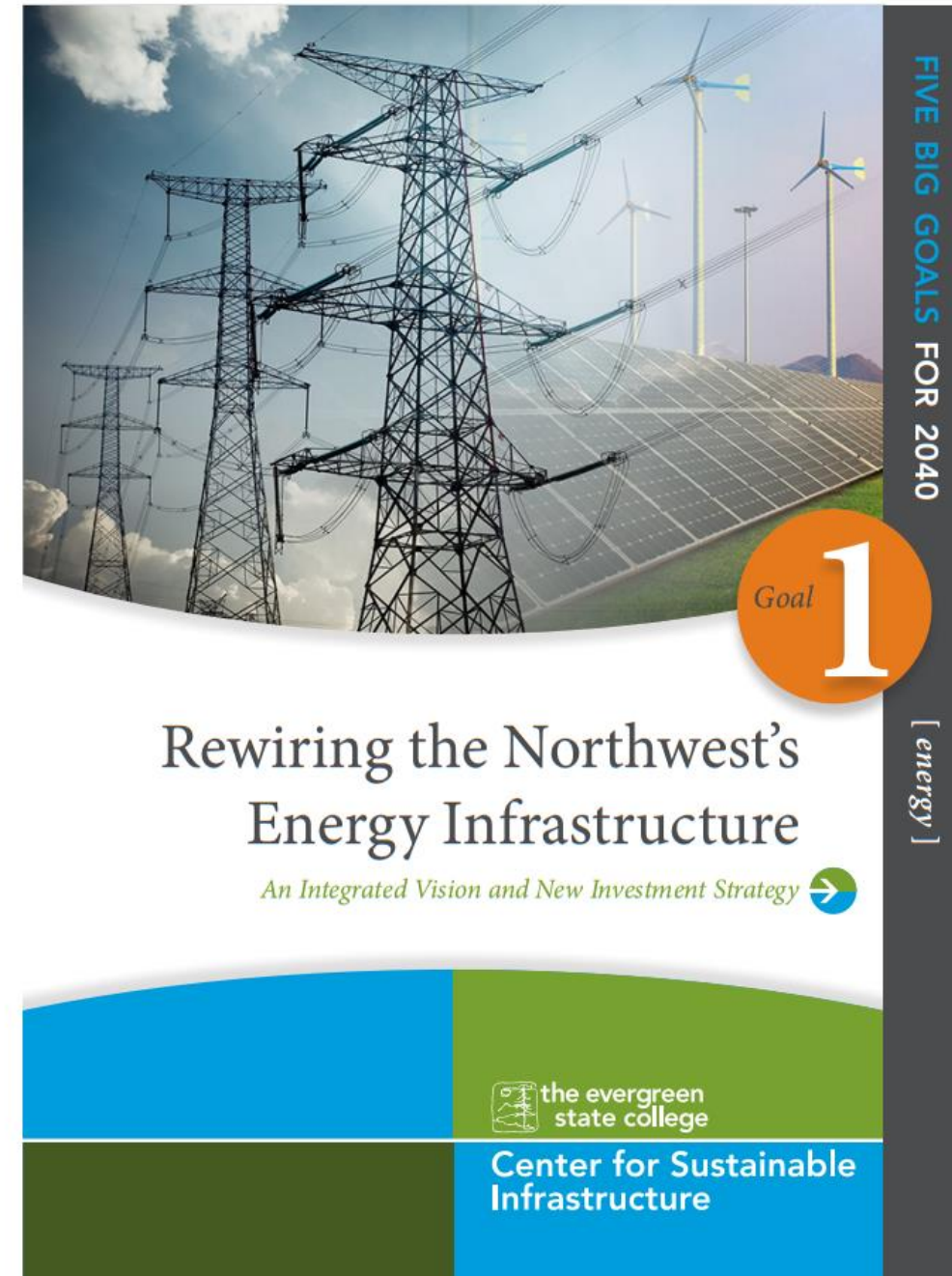




5 Big Goals for 2040 series: First Up - ENERGY

The Design Question:

How can the Pacific Northwest
develop an integrated energy
system - for electricity,
transportation, heating and cooling
-- **among the most sustainable,
resilient, and affordable in the
world?**



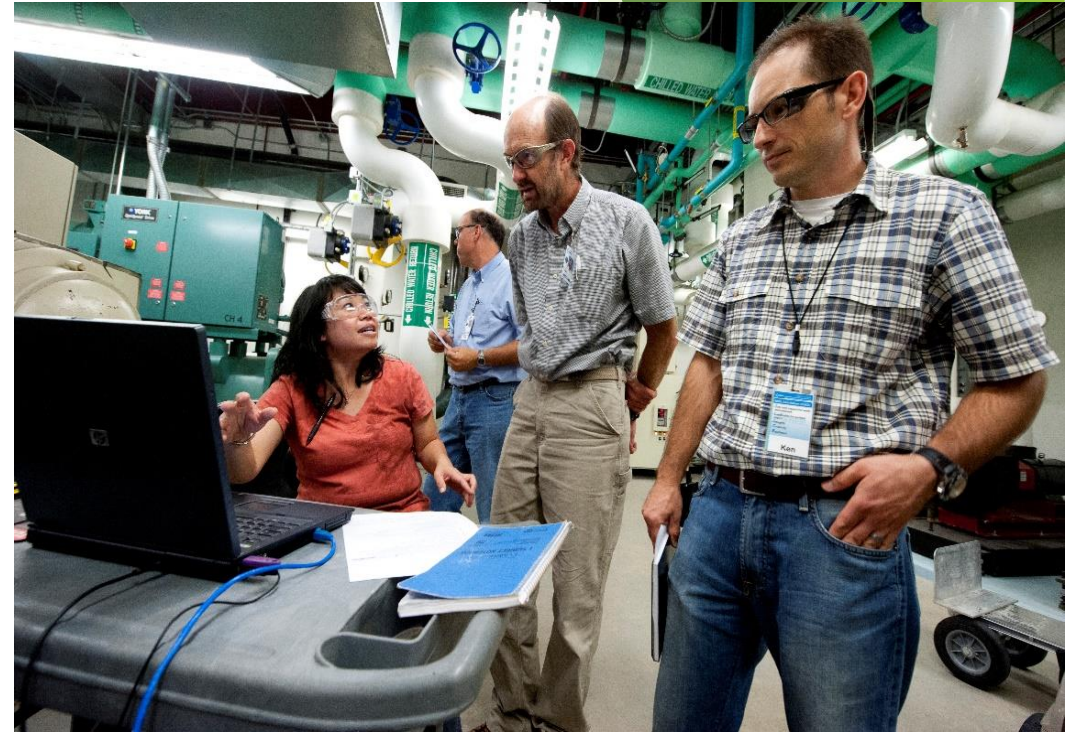
Is there a win-win shared vision?

Can we have an energy system
that **performs better**,
for the **same or lower cost**,
that **gives our kids clean air**,
and in which **our utilities are
financially healthy...?**



Constructing a 2040 Northwest Energy Vision

- ▶ **Sit-down interviews** with 33 energy leaders: utilities, regulators, advocates, companies, public agencies, academics...
- ▶ **Supplemented** by wide-ranging literature review
- ▶ **Thorough review** by 20-member Executive Review Team



We're Entering a Very Exciting, Transformative New Era...

- ▶ *Rapidly declining costs* and improving performance for 'disruptive' new tech
- ▶ *Spreading like wildfire*: Commitment among citizens, businesses, and policymakers to shrink our carbon footprint
- ▶ *Integrated energy solutions* that dissolve boundaries b/w electric, transportation, and heating-cooling silos



Key Drivers for Transformative Change

▶ Disruptive Technologies

- Customers will bring billions of dollars in new investment to our energy infrastructure

▶ Disrupted Utilities

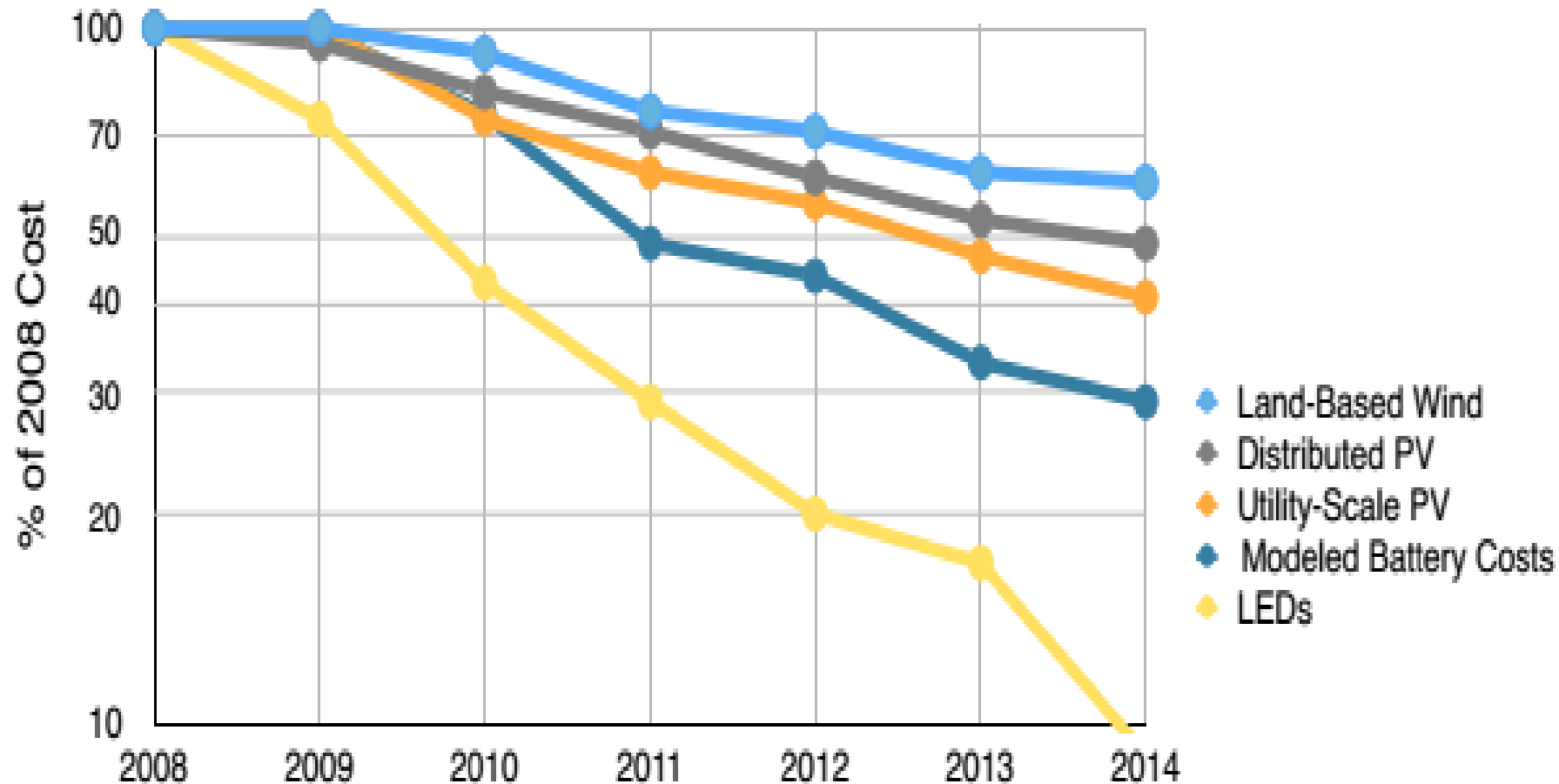
▶ Aging Infrastructure, Aging Workforce

▶ Clean Air and Climate Change Policy

▶ The Resilience Imperative

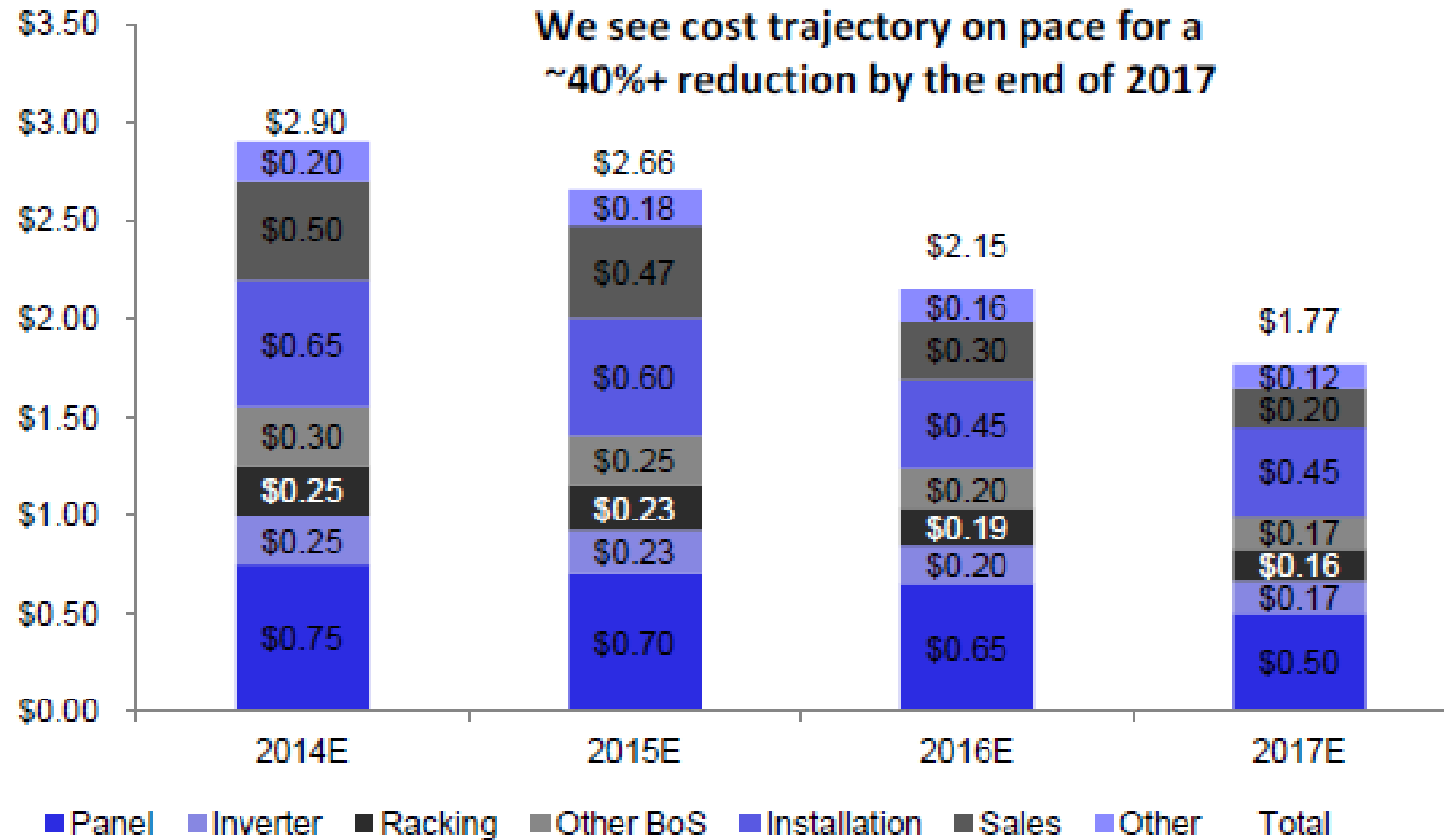


Falling Costs for Clean Energy Tech



Solar PV: No Plateau in Sight for Declining Costs

Figure 39: Cost Reduction Example: USA



Source: Deutsche Bank

Energy Tools in Customer Hands

- ▶ Customers = *People + Companies + Institutions + Governments*
- ▶ The New Energy Marketplace: *Save/make money and cut your carbon footprint with products to **Produce + Reduce + Manage Energy***

Produce Energy:

- Solar PV

Reduce Energy:

- Super-efficient equipment and buildings
- Convert from petroleum cars to EVs

Manage Energy:

- Store energy + flex timing of demand



The Future of Cars:

Will We Witness the End of Petroleum's 100-Year Reign?

- ▶ Tesla advertises its 2016 electric Model X as the 'safest, fastest, and most capable SUV in history'
- ▶ Tesla's mass market (\$35k) Model 3 reservations over 400,000
- ▶ Also in the race to mass market EVs: BMW, Mercedes, GM, Ford, Toyota, Honda, Nissan, Renault and Kia

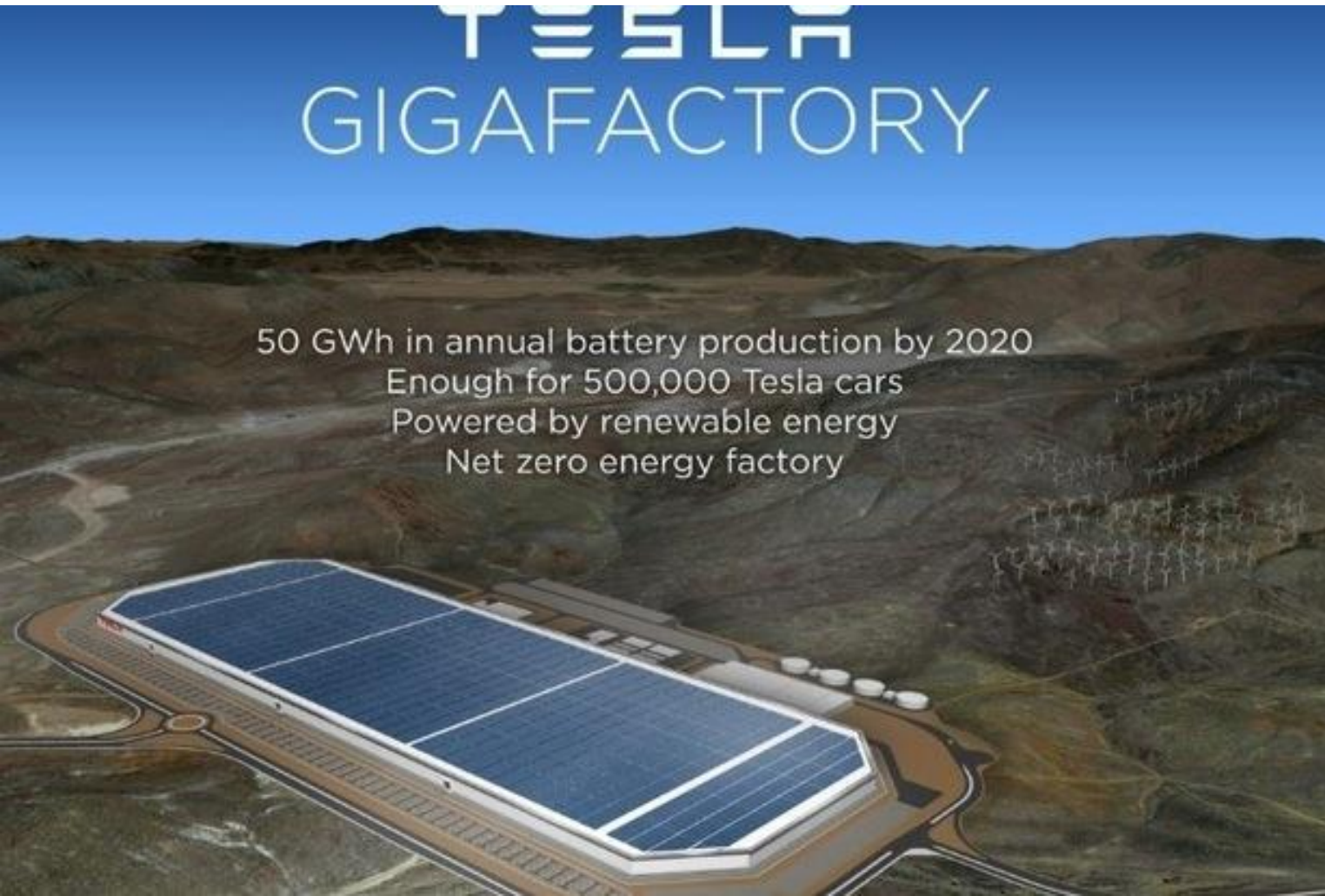


"There are an awful lot of companies right now playing with electric cars and... self-driving cars. This is the future and it might be huge ... and it is perfect territory for a company like Apple."

-- Apple co-founder Steve Wozniak



Tesla's 'Gigafactory': A game-changer for battery costs?

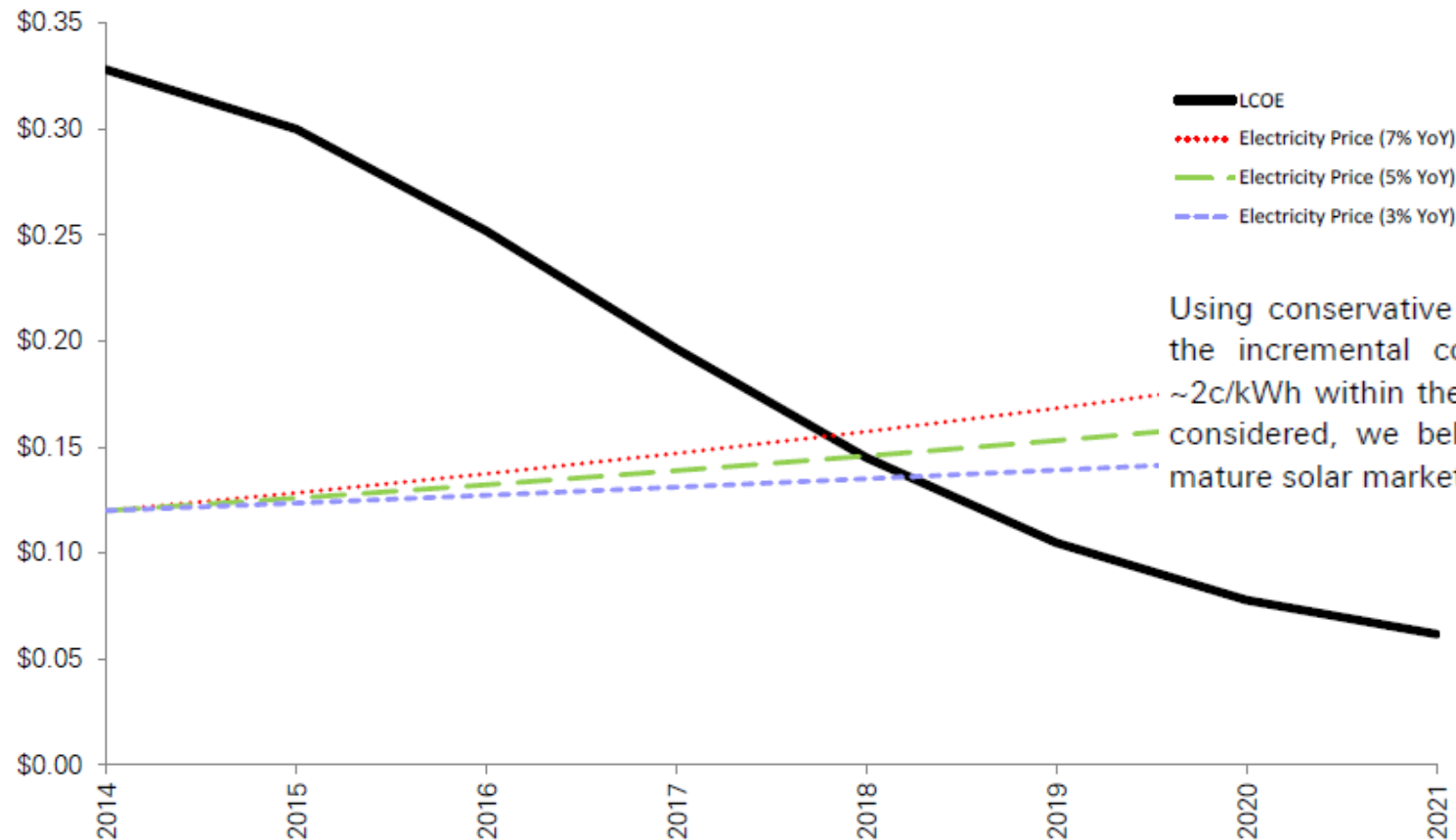


Competitors aiming to scale battery production:

- BYD (Chinese, Buffet-backed)
- Samsung
- Foxconn
- Possibly Apple

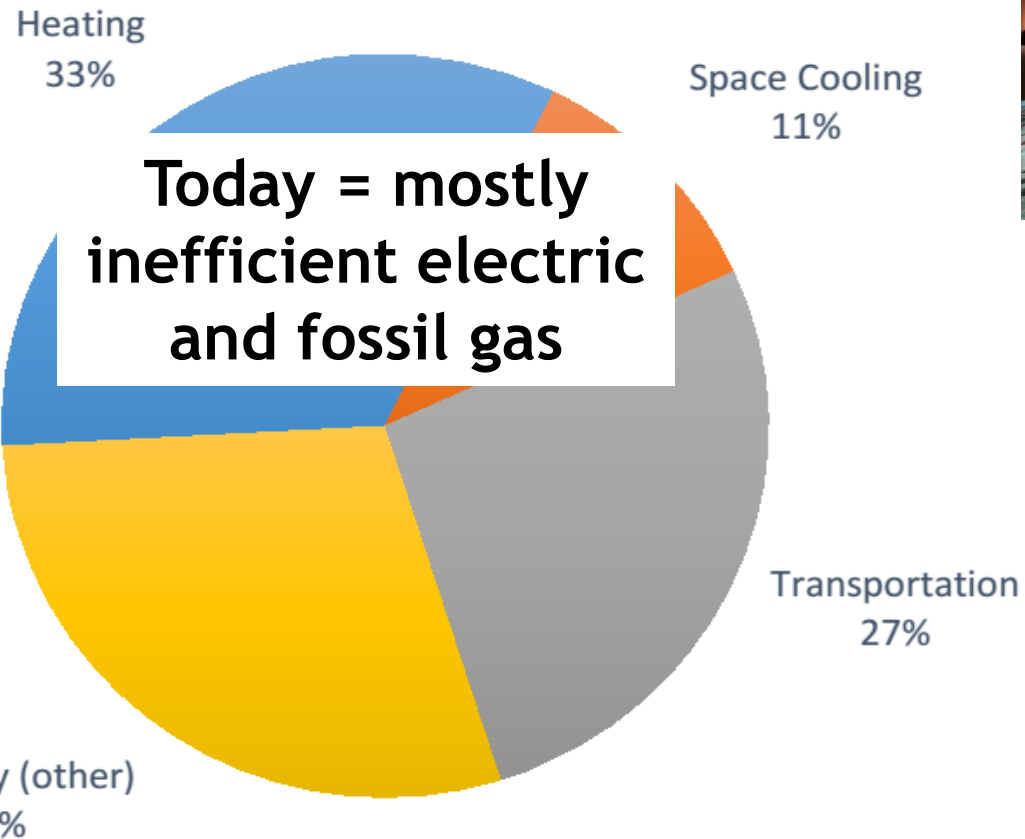
Solar + Batteries: Soon-to-be 'Clear financial choice'?

Figure 44: Illustrative example of System with Batteries at Grid Parity Assuming 10% total system cost reduction YoY



Using conservative assumptions and no incentives, our model indicates that the incremental cost of storage will decrease from ~14c/kWh today to ~2c/kWh within the next five years. When overall system cost decreases are considered, we believe solar + batteries will be a clear financial choice in mature solar markets in the future.

It's not just about Electric
or even Transportation
Heating is HUGE, too



... another 11% is for cooling!

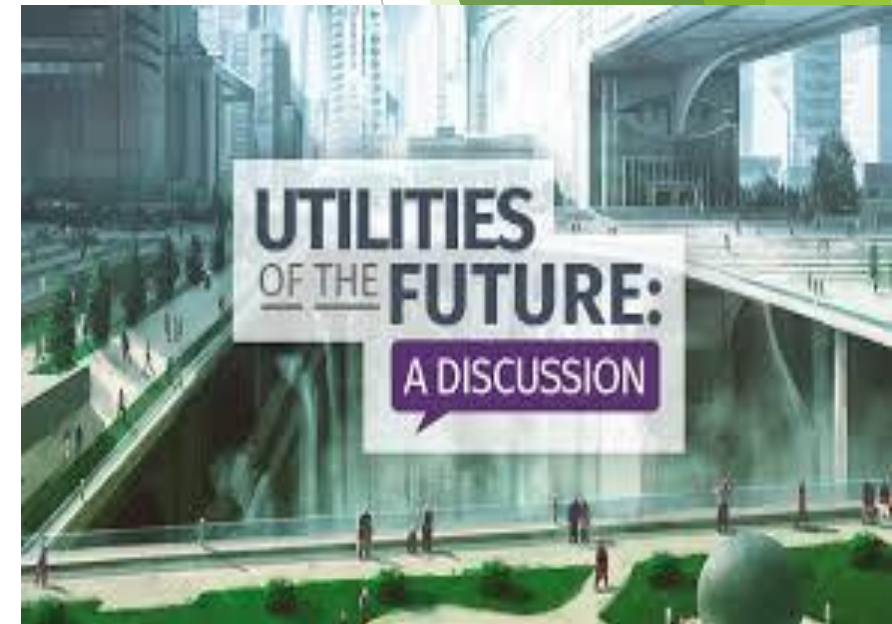
Heat-Cool

The Invisible Half of the Energy Challenge



Is there a Future for Our Utilities?

- ▶ **Today's utility business model doesn't work**
 - ...for the coming transformed energy marketplace
- ▶ **We need healthy utilities!**
 - Utilities are one of the 20th century's great social innovations, providing vital services affordably to everyone
 - Can enable us to invest in big valuable systems for broad benefit





“The 20th century model was about a **shared system that created huge public benefit...** The 21st century’s challenge is to keep the best - shared and public benefit - and make it clean and more resilient.” - Roger Gray

What We Need from a New Utility Compact

- **Powerfully incentivize utilities to invest in smart infrastructure pathways**
 - ✓ Smart investment optimizes economic, environmental, and community value on the lifecycle
- **Outcomes-Based:**
 - ✓ Utilities pay for performance -- actual benefits delivered to our shared infrastructure
 - ✓ Base utility returns, not on capital spend, but on achieving performance metrics that serve state- or system-wide goals.
 - Can we ensure utilities can reliably recover long-term costs for smart investments, even as the energy marketplace transforms?



Rethinking the Utility Business Model

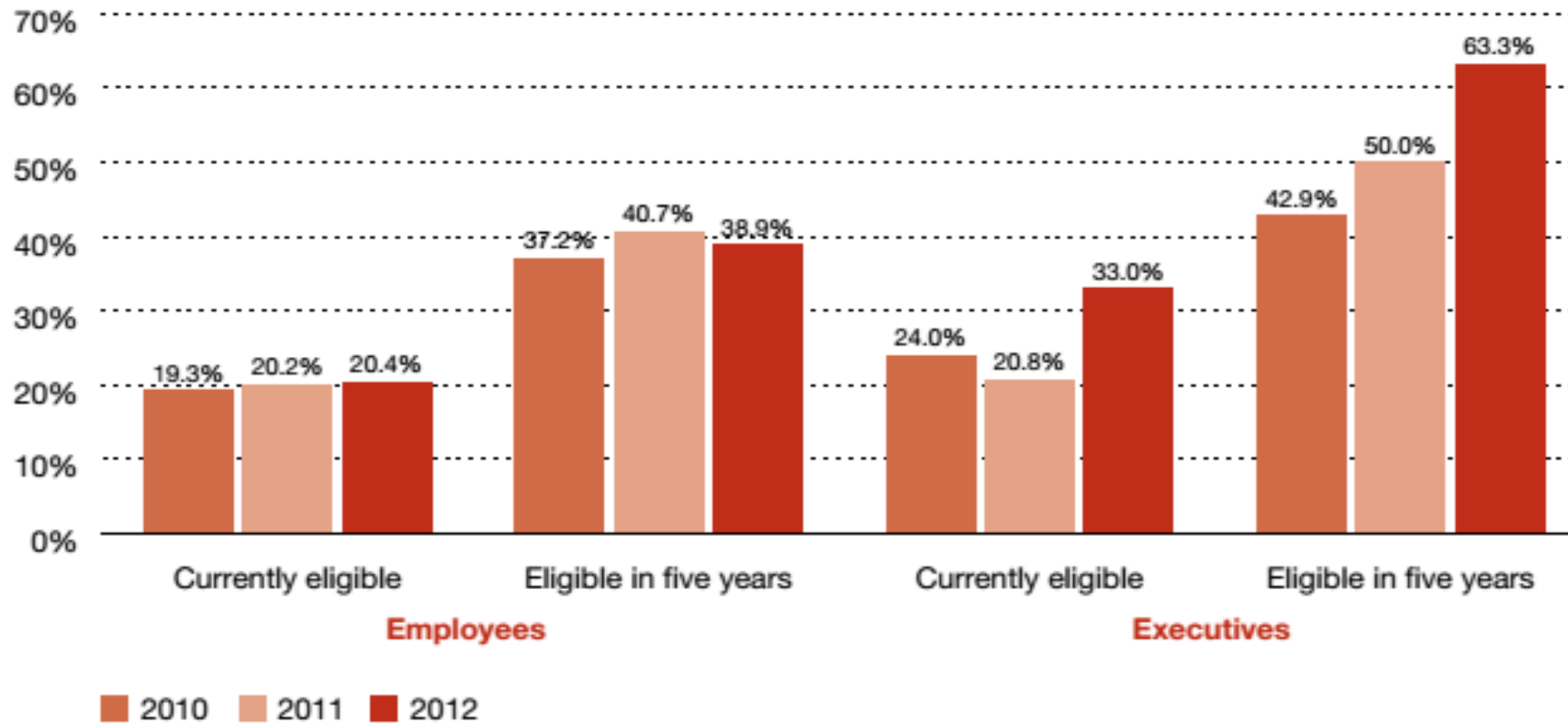
- ▶ **Best investments ‘do more than one thing’**
 - Produce clean energy or cut energy demand
 - Reduce peaks
 - Provide demand flexibility
 - Increase resilience, cut downtime (via microgrids?)
- ▶ **What’s the actual *Value of Solar*?**
 - It’s probably location specific
 - There are direct benefits to the system, and broader community benefits
 - both matter, and need to be counted



Utility Workforce + Decision-Maker Turnover



U.S. Utilities Face a Great Retirement Wave



Redesigning State Policy

State Leadership -- Key to steering change to optimize value and benefits for everyone

- ▶ State vantage point spans silos
- ▶ Serves the broad public interest

A New State Infrastructure Strategy

- ▶ Vision and System-Wide Goals
- ▶ Performance Metrics
- ▶ Principles for Innovation
- ▶ Rethink the Utility Compact
 - ...and the layers of inherited regulations, policies and processes developed for the old energy marketplace



Golden Economic Opportunity!

NW Spend on Fossil Fuels = **\$30B/year**

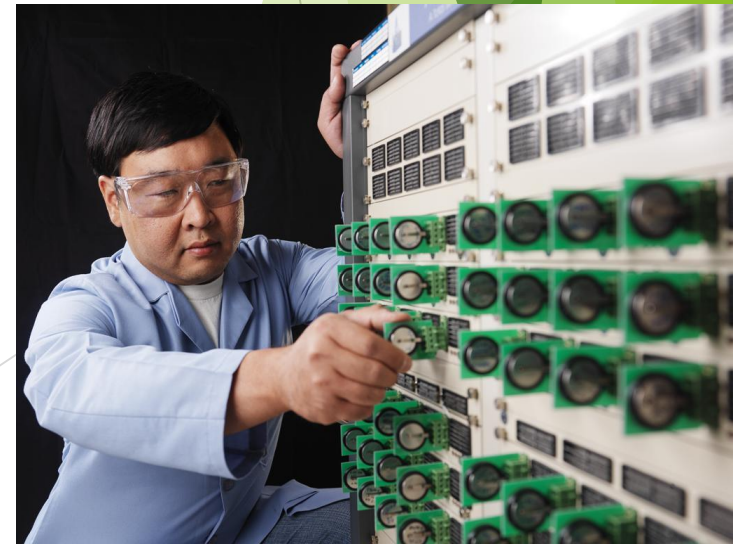
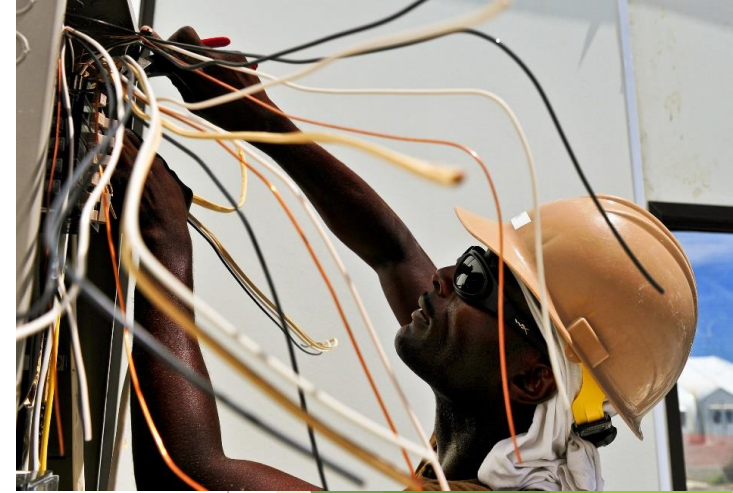
Convert that **\$\$ drain of imported energy** into a **faucet of local energy jobs**:

✓ Energy infrastructure jobs program:

- **Aim Big**: Develop a world-class, integrated, virtually fossil-free energy system
- Ensure **strong markets** to sustain a vibrant ecosystem of local companies - including solar providers!
- Develop the **next-gen workforce**

✓ Ramp up R&D

- Make the NW a **Living Laboratory** for solving key advanced energy challenges
- State investment will **pull in federal and private \$\$**



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