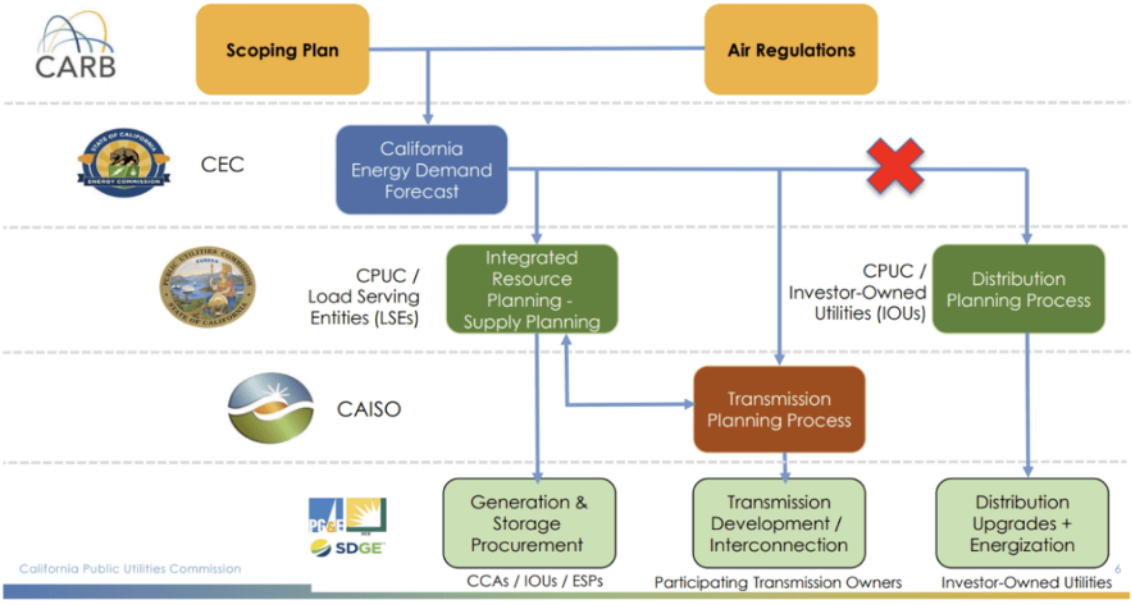
Energy Tetris: A Blueprint for the Future of Grid Planning

Energy Planning in California: the Wrong Optimization Problem

California is facing the perfect storm of energy unaffordability, renewed load growth, and escalating climate impacts. Yet the state's energy planning processes were designed for a 20th-century grid without bi-directional power flows or distributed resources, and they therefore solve the wrong optimization problem.

California Statewide Energy Planning Processes – High Level Overview



Siloed Process

California's energy planning process remains segmented across agencies and planning silos rather than integrated around minimizing system cost and maximizing net system value.

Three Structural Flaws that Limit DER and Increase Grid Costs

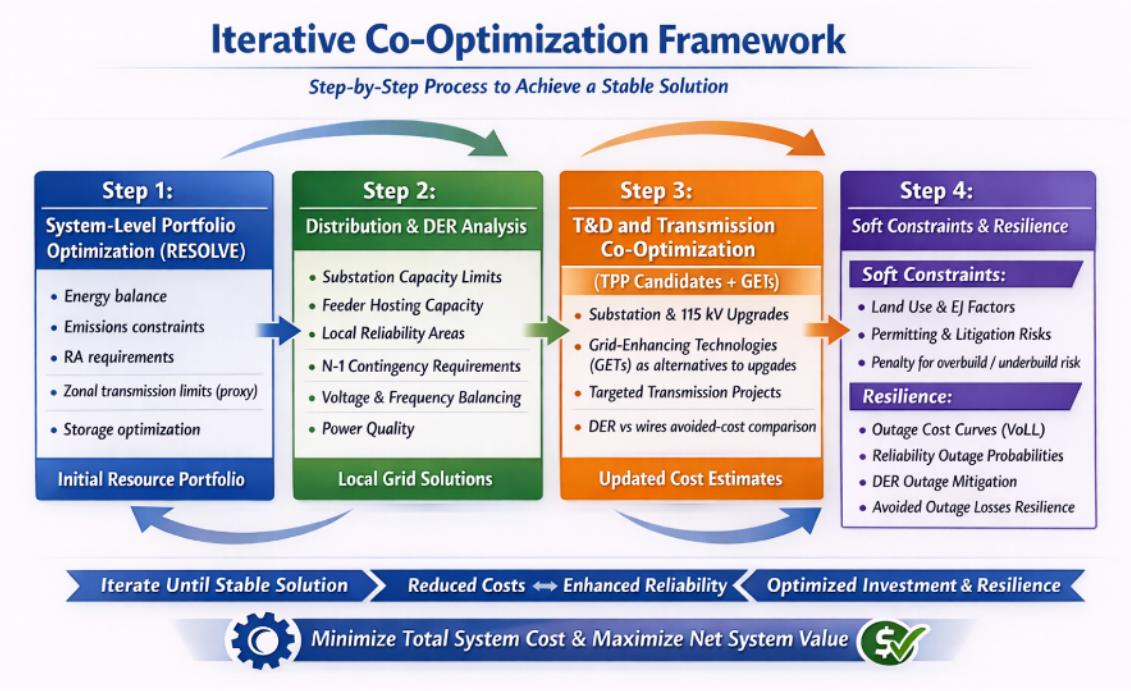
1) As highlighted by the red "X," *distribution planning remains siloed from Integrated Resource Planning (IRP) and the Transmission Planning Process (TPP).* With portfolio and transmission decisions made without integrating distribution-level solutions, local reliability needs are met with infrastructure expansion rather than targeted resource deployment.

2) *The existing IRP (and TPP) are largely location-agnostic, optimizing portfolios at the zonal level without tying resources to specific substations or feeders.* As a result, local constraints are not considered until the distribution planning process, by which time it is too late to make the most impactful and cost-effective investments capable of addressing energy and grid needs.

3) *DER, especially Front-of-Meter DER, is structurally excluded from scenario planning in the IRP or SB 100 reports.* The result is an optimization that minimizes system generation costs at the transmission interface, while distribution-level constraints and infrastructure costs remain outside the objective function.

Fully Integrated Grid Planning: The Four-Step Energy Tetris Solution

Integrated grid planning requires a co-optimized loop that evaluates generation, transmission, and distribution investments **together** while internalizing infrastructure costs within portfolio decisions and allowing distributed resources to compete directly with conventional "wires" solutions. This entails a four-step iterative co-optimization framework: each step can be run multiple times to incorporate feedback from subsequent steps, allowing the final portfolio to converge on a stable solution that accurately reflects total system cost and maximizes ratepayer benefits.



Co-Optimization Framework

- Distribution planning occurs earlier to identify locations where deployments can increase utilization of existing infrastructure.
- Once distribution and DER analysis occurs, the iterative loop feeds the results back to Step 1 where incremental transmission and grid enhancement technologies can then be evaluated.
- Step 4 incorporates risk and non-energy impacts that routinely affect Californians but are largely excluded from core portfolio optimization.
- The process iterates repeatedly until the most optimal "tetris" of distribution and transmission level resources emerges.

Bottlenecks

- Timing Alignment: A two-iteration cap per cycle will ensure enlignment between IRP cycles, TPP, and distribution planning.
- Decision-grade data interfaces: standardized outputs will allow planning entities to exchange comparable inputs while protecting confidentiality.