Electricity Policies and Business Strategy

A California Perspective

Electricity 2018

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Together, Building a Better California

Pacific Gas and Electric Company (PG&E)

Company Facts

- Fortune 200 company headquartered in San Francisco, CA
- $17.1 billion in operating revenues in 2017
- More than 20,000 employees

Service Territory

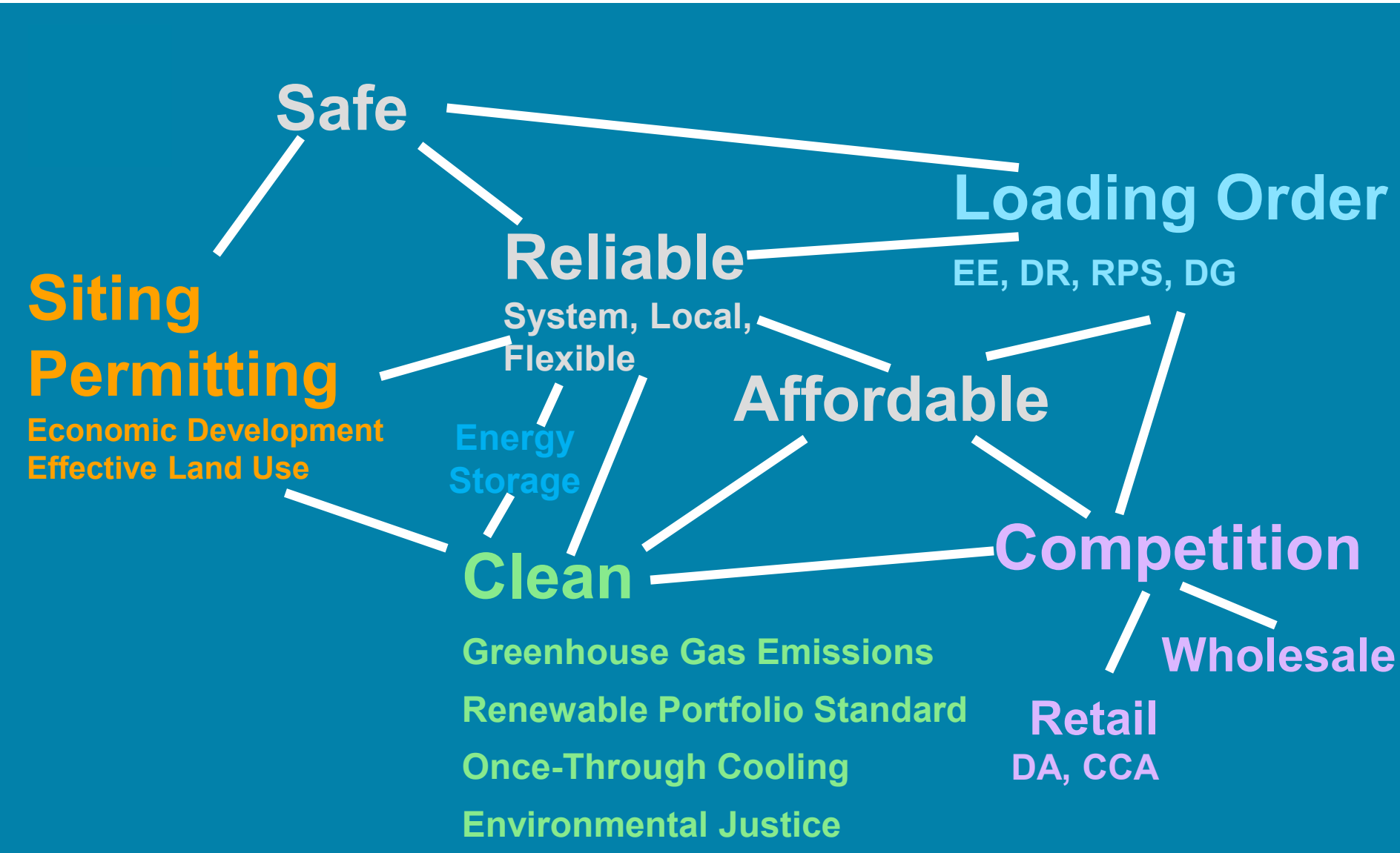
- 16 million people
  - 5.4 million Electric accounts
  - 4.3 million Natural Gas accounts
- $1 trillion in gross domestic product
- 70,000 square miles with diverse topography

Electricity Delivery

- 106,681 circuit miles of electric distribution
- 18,466 circuit miles of electric transmission
- 86,600 GWh of annual retail sales
- 20,000 MW of peak load

Source: http://www.pge.com/en/about/company/profile/index.page ;PG&E 2017 10-K filing at SEC; PG&E 2019 Energy Resource Recovery Account filing at CPUC (1 June 2018)

California's Web of Energy and Environmental Policies



California #1

MYTH **The Utility is a vertically-integrated monopoly.**

TRUTH **The Utility is somewhat vertically integrated.**
The Utility is *not* a monopoly.

FINE PRINT

Generation is competitive.

- California Independent System Operator (CAISO) operates day-ahead and real-time markets. CAISO footprint comprises 80% of California statewide electric load.
- Gas-fired power plants and renewables are mostly owned by third parties, not Investor-Owned Utilities
- Increasing competition from behind-the-meter rooftop solar

Transmission has limited competition.

- Competition to build new transmission projects, per CAISO tariff and Federal Energy Regulatory Commission (FERC) Order 1000
- Transmission planning decisions are made by CAISO

Distribution has been a monopoly, but is changing.

- Increasing competition from “nonwires alternatives,” primarily Distributed Energy Resources

Retail has restricted competition.

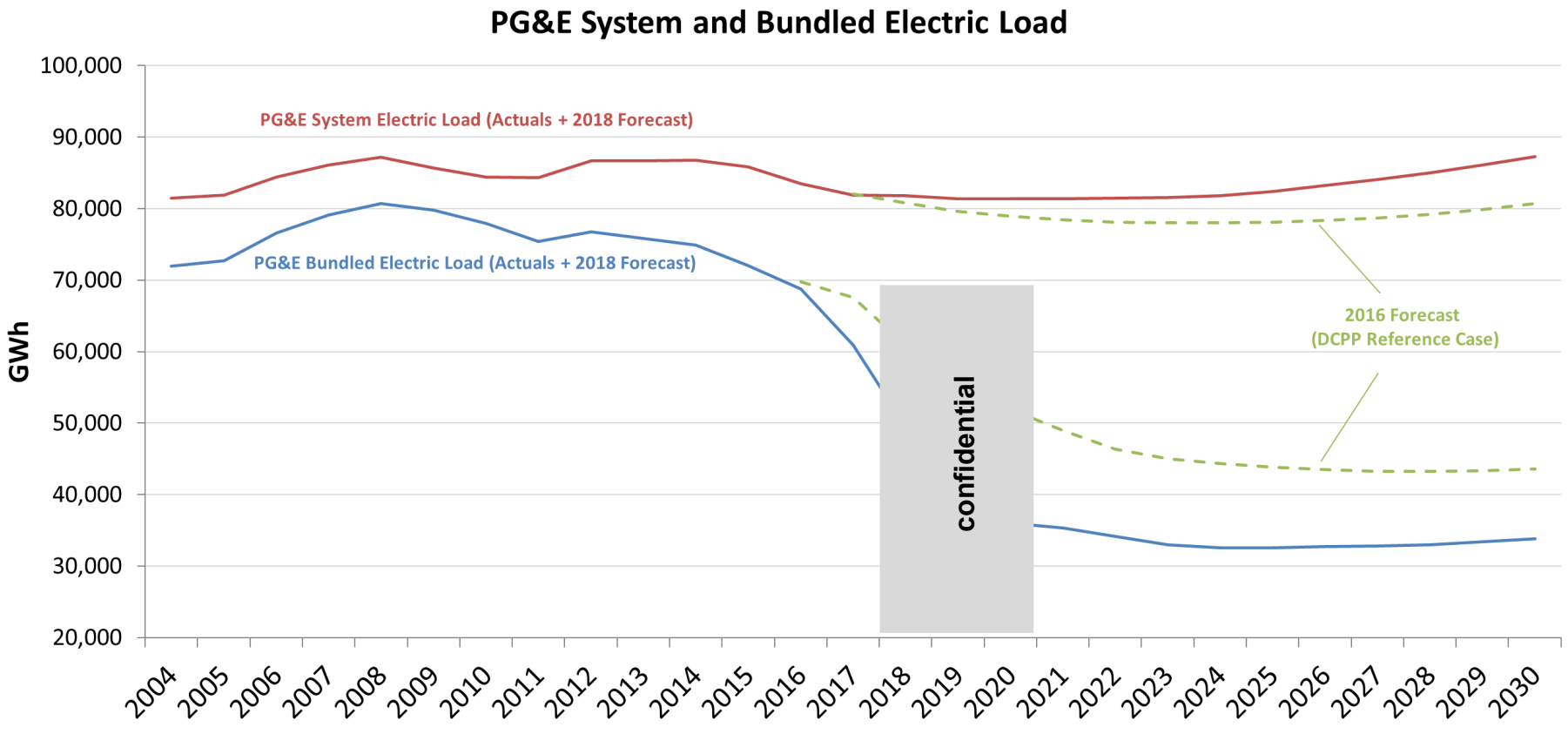
- Legislative limits on Direct Access (DA)
- Competition mostly from Community Choice Aggregation (CCA)
- Investor-Owned Utility has obligation to serve and is provider of last resort

Retail is not a monopoly

Alternative retail providers

(Direct Access, Community Choice Aggregation)

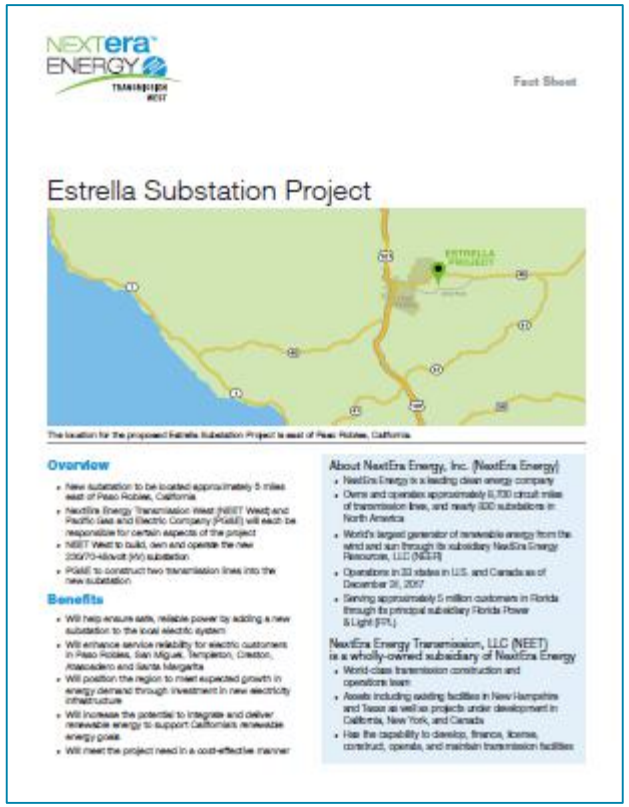
serve a significant portion of customer electric load



Source: PG&E Recorded Systems Sales, July 2016 PG&E Approved Load Forecast for DCPP Reference Case, March 2018 PG&E Approved Load Forecast

Transmission is no longer a monopoly

Estrella Substation Project



This report describes the competitive solicitation process conducted by the California Independent System Operator Corporation (ISO) for the Estrella Substation project, including a new 230/70 kV substation… The ISO has conducted this competitive solicitation because, in its 2013-2014 transmission planning process, the ISO identified a reliability-driven need for system reinforcement

California #2

MYTH **The more electricity the Utility sells, the more money the Utility makes.**

TRUTH **False.**
The Utility does not make more money by selling more electricity.

FINE PRINT

Decoupling separates revenues and sales.

- In 1982, California "decoupled" Investor-Owned Utility revenues from electricity sales.
- An investor-owned utility's revenues are based on costs and are indifferent to sales.

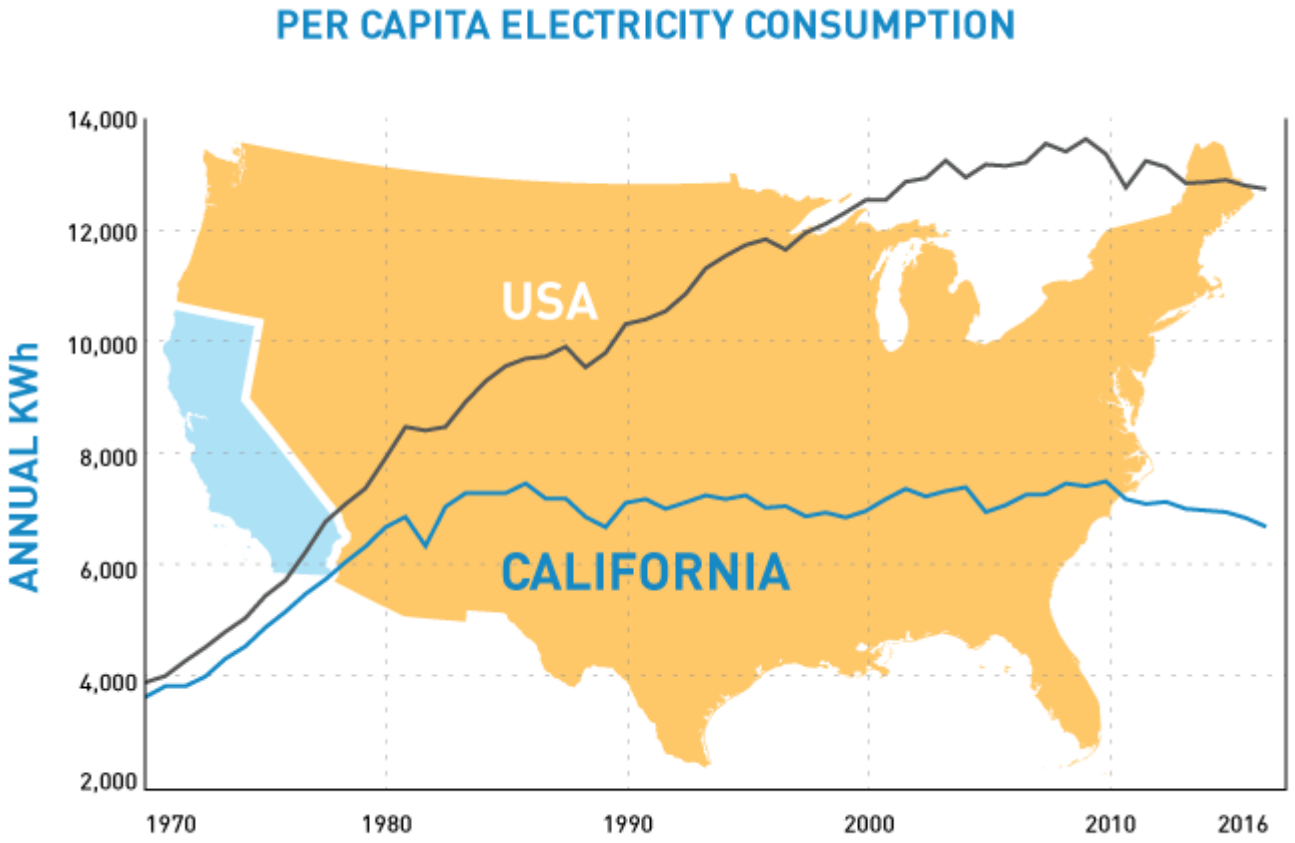
Energy efficiency incentive results in a modest increase in profit when sales are lower because of excellent energy efficiency results.

Different components of the value chain are regulated differently, by different authorities.

- **Electric distribution** is regulated by California Public Utilities Commission (CPUC) regulates electric distribution. CPUC implements decoupling.
- **Electric transmission** is regulated by Federal Energy Regulatory Commission (FERC). There is no decoupling for electric transmission: higher sales lead to higher revenues and earnings.

California's Energy Efficiency Policy: Result

"The Rosenfeld Effect"
California has had 40 years of no growth in electric consumption per capita



Source: CEC, EIA, US Census, CA Department of Finance

California #3

MYTH **Solar is cheaper than conventional power.**
Solar is more expensive than conventional power.

TRUTH **It all depends.**
Anyway, net value is what matters.

FINE PRINT

Cost, particularly Levelized Cost of Energy (LCOE)

- Convenient for simple reporting
- Not a very useful comparison for commercial decision-making

Not all MWh are the same.

- Time
- Location
- Market conditions

Not all MWs are the same.

- Reliability
- Location
- Flexibility

Net value is benefits minus costs.

- Valuation begins with market benchmarks
- Valuation includes adjustments for unique portfolio considerations

Business Strategy #1

Update Our Jargon	
from	to
Ratepayers	**Customers**
Value Chain	**Value Web or Ecosystem**
Rates, Tariffs	**Pricing**
Customer Classes	**Customer Segments**
Products and Services	**Products and Services**
Customers	**End Users**
Strategy	**Itinerary**

Competitiveness Increasing throughout the value chain

Generation

Delivery

Retail

1980

2000

2018

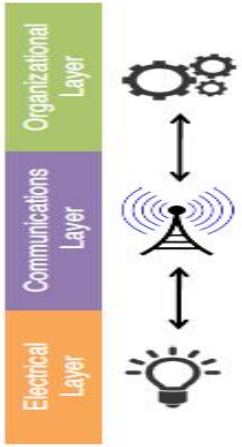
2025

Going Beyond the Value Chain

Our electricity system is complex, and identifying sources of value and opportunities to capture it needs more than a chain.

The electricity system is not sequential but rather a network of connections—we need a **system value chain** to describe it instead of a linear value chain.

Any electricity system has three fundamental layers.



The **organizational layer** is where operational decisions are made to govern an electricity system.

The **communications layer** is the set of communication assets and activities that create and manipulate data to generate useful information for decision making.

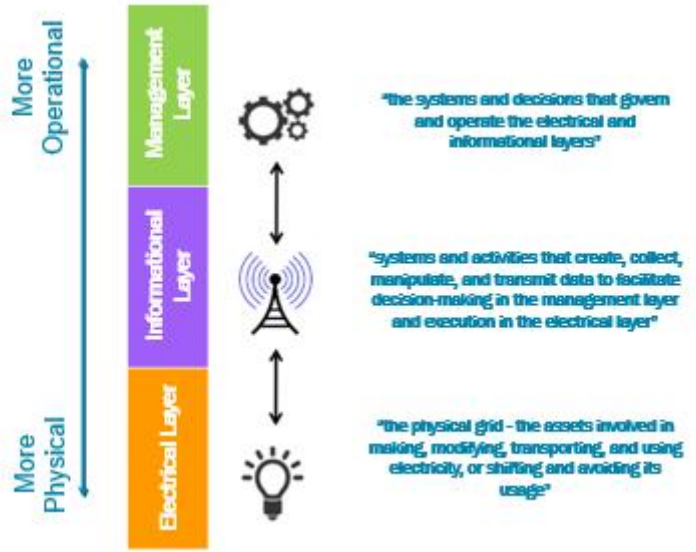
The **electrical layer** is the physical grid—the assets involved in making, modifying, and using electricity.

from "The Electricity System Value Chain,"
E-Lab at Rocky Mountain Institute, March 2015

Building the Value Web

1) Begin with the 3 layers of the value chain…

2) Incorporate a layered business perspective, similar to RMI



3) Consider four "types"

Activities

Products and Services

Entities

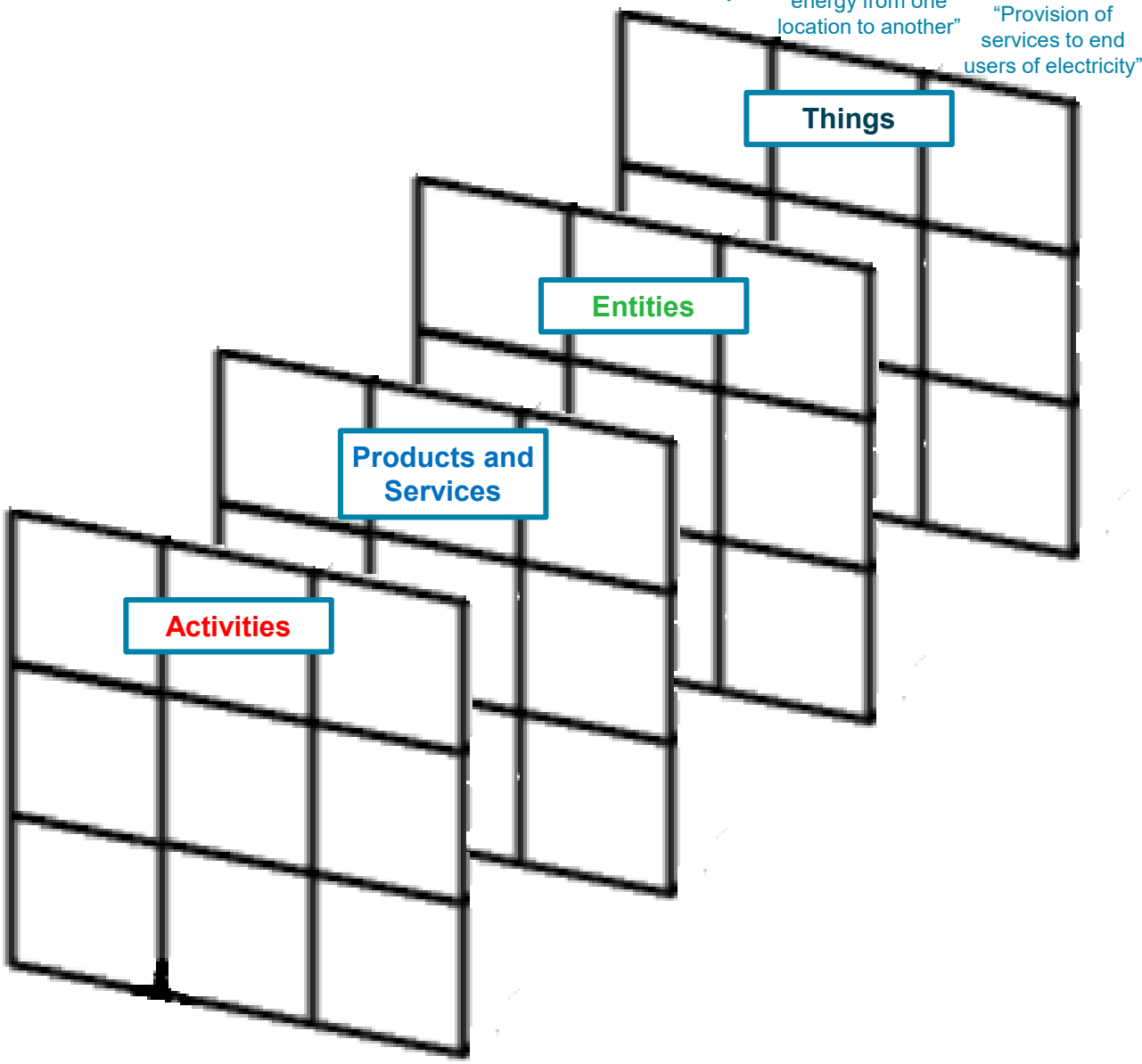
Things

Value Web

Generation
"Producing electricity"

Delivery
"Moving electrical energy from one location to another"

Retail
"Provision of services to end users of electricity"



Management Layer
"the systems and decisions that govern and operate the electrical and informational layers"

Informational Layer
"systems and activities that create, collect, manipulate, and transmit data to facilitate decision-making in the management layer and execution in the electrical layer"

Electrical Layer
"the physical grid - the assets involved in making, modifying, transporting, and using electricity, or shifting and avoiding its usage"

The 'Activities' Cross-Section of the Value Web

	Generation "Producing electricity"	Delivery "Moving electrical energy from one location to another"	Retail "Provision of services to end users of electricity"
Management Layer "the systems and decisions that govern and operate the electrical and informational layers"	• Buying and Selling Electric Energy • Hedging Price Risk • Permitting Power Plants • Dispatching Power Plants (determining to run a plant or not) • Deciding when to repair and maintain generation assets	• Permitting lines • Deciding whether or not to repair FTM storage • Buying and selling electric energy • Scheduling transmission clearances • Designating lines or corridors	• Hedging price risk • Deciding whether or not to repair a BTM DER • Educating customers • Providing DSM services • Answering customer questions • Buying and selling electric energy
	Designing Market Rules (Governing) Maintaining relations with stakeholders		
Informational Layer "systems and activities that create, collect, manipulate, and transmit data to facilitate decision-making in the management layer and execution in the electrical layer"	• Monitoring load • Analyzing aggregate load data (long term trends) • Forecasting supply/demand balance • Sending dispatch signals to power plants	• Monitoring load • Monitoring FTM DER • Analyzing aggregate load data (short term operations & long term planning) • Forecasting supply/demand balance	• Billing customers • Monitoring PV/EE/Battery assets BTM • Analyzing customer data [for educating customers] • Answering customer questions • Identifying customers for PV/EE/Storage sales
Electrical Layer "the physical grid - the assets involved in making, modifying, transporting, and using electricity, or shifting and avoiding its usage"	• Converting fuel to electricity • Constructing power plants • Installing BTM solar PV • Repairing BTM PV/Wind/Fuel Cell assets • Repairing or maintaining any generation asset	• Delivering electricity • Repairing FTM Storage • Repairing wires • Constructing T&D lines • Storing electricity	• Consuming electricity • Installing behind the meter energy efficiency thing • Monitoring customer usage and generation

Business Strategy #2

- Seemingly simple questions
- "Standard" tools: Voice of the Customer (from Lean Six Sigma)

What is the grid?

Who are the customers?

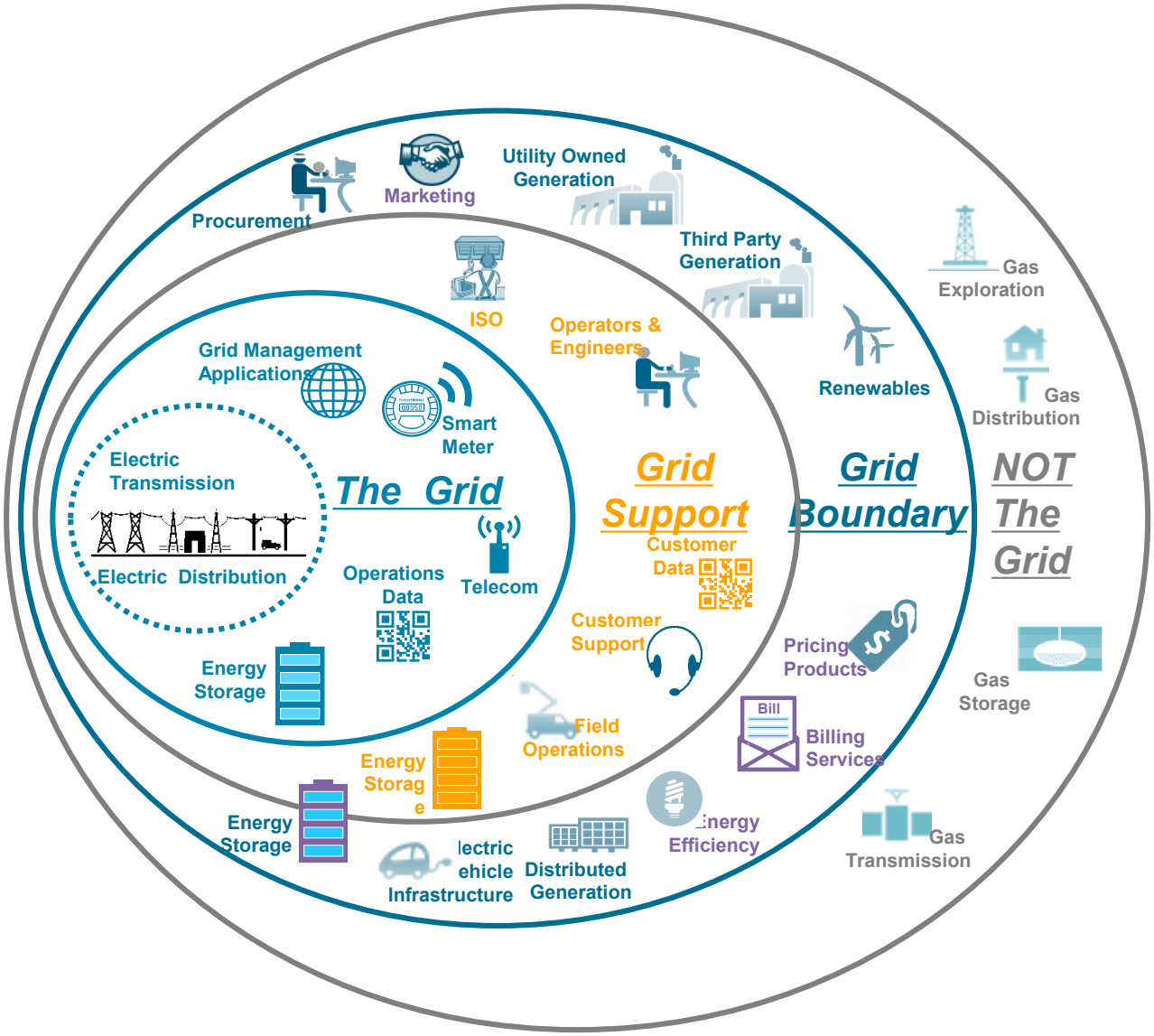
What do the customers need or want?

What products or services can the grid provide,
to meet those customer needs and wants?

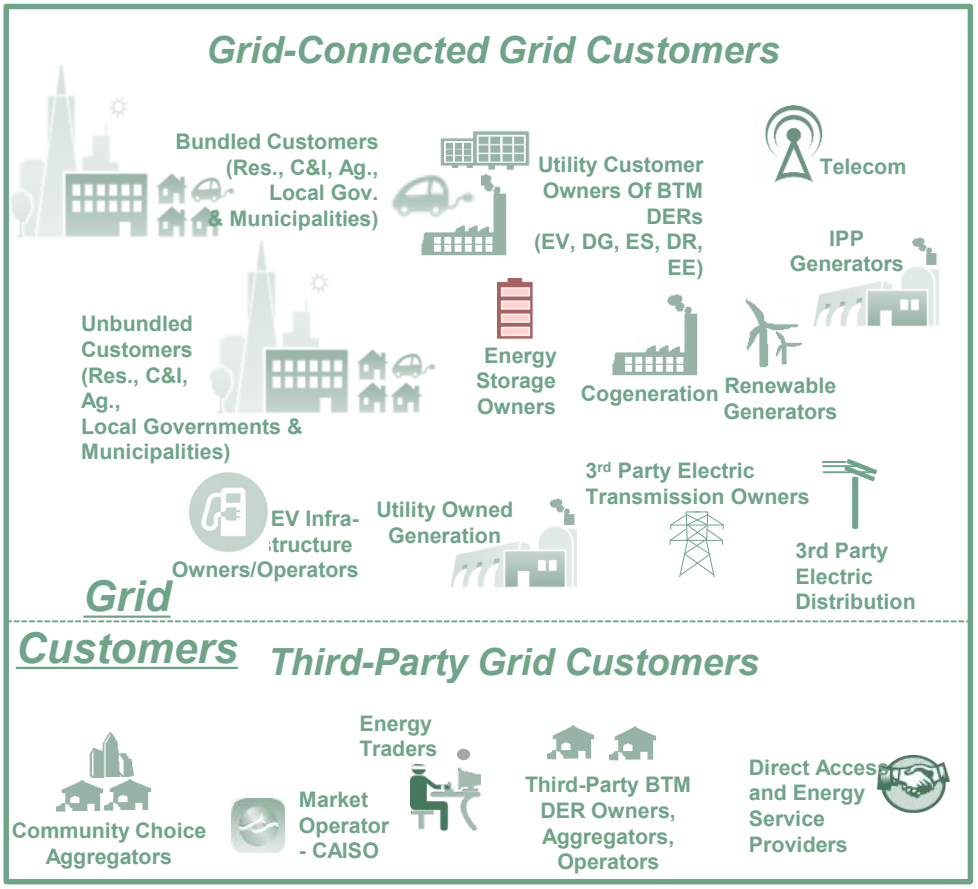
One View of *What is "the Grid"?*

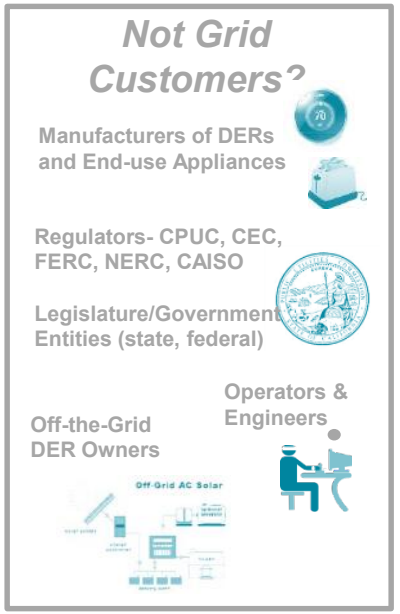
Definitions

- **"The Grid":** Anything between two meters that is connected by utility wires or equipment.
- **"Grid Support":** peripherals to "the grid" that are part of the grid, such as operators and the call center.
- **"Grid Boundary":** Sources and sinks for electrons that are transported through the grid.
- "Not The Grid"



One View of *Who are Grid Customers?*



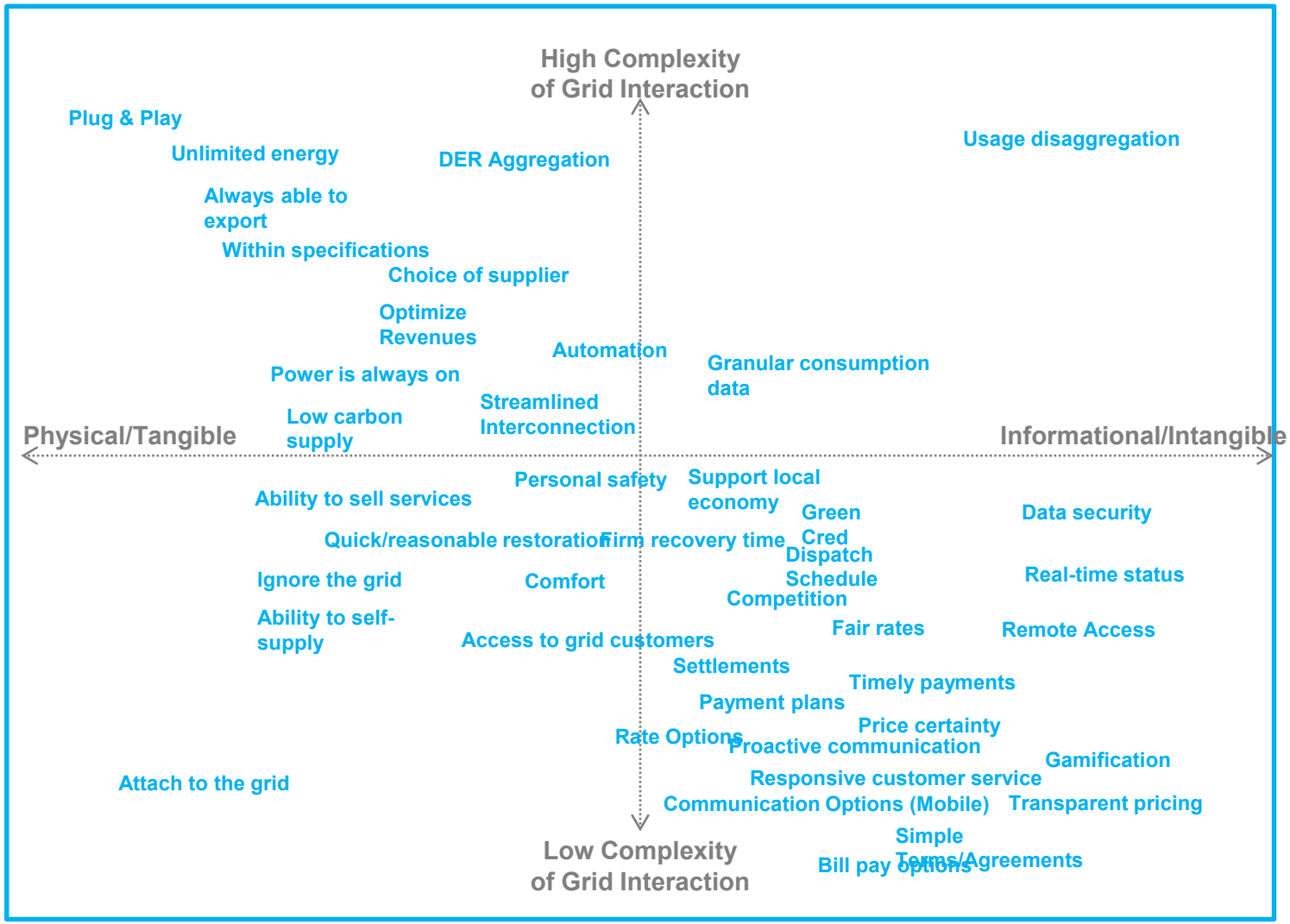


Definitions

- **"Grid Customers":** A grid customer is an entity that gives or takes goods or services provided via the grid. There are two types of Grid Customers:
  1. **Grid-connected grid customers**, who give/take services provided via the grid, and
  2. **Third-party grid customers**: entities that have an electricity-related contract/agreement with their customers and need customers to be connected to the grid because their value offering or service relies on grid services, but who do not need to be connected to the same grid as their customers.

One View of *What are the Wants and Needs of Grid Customers?*

Grid Customer Needs & Wants

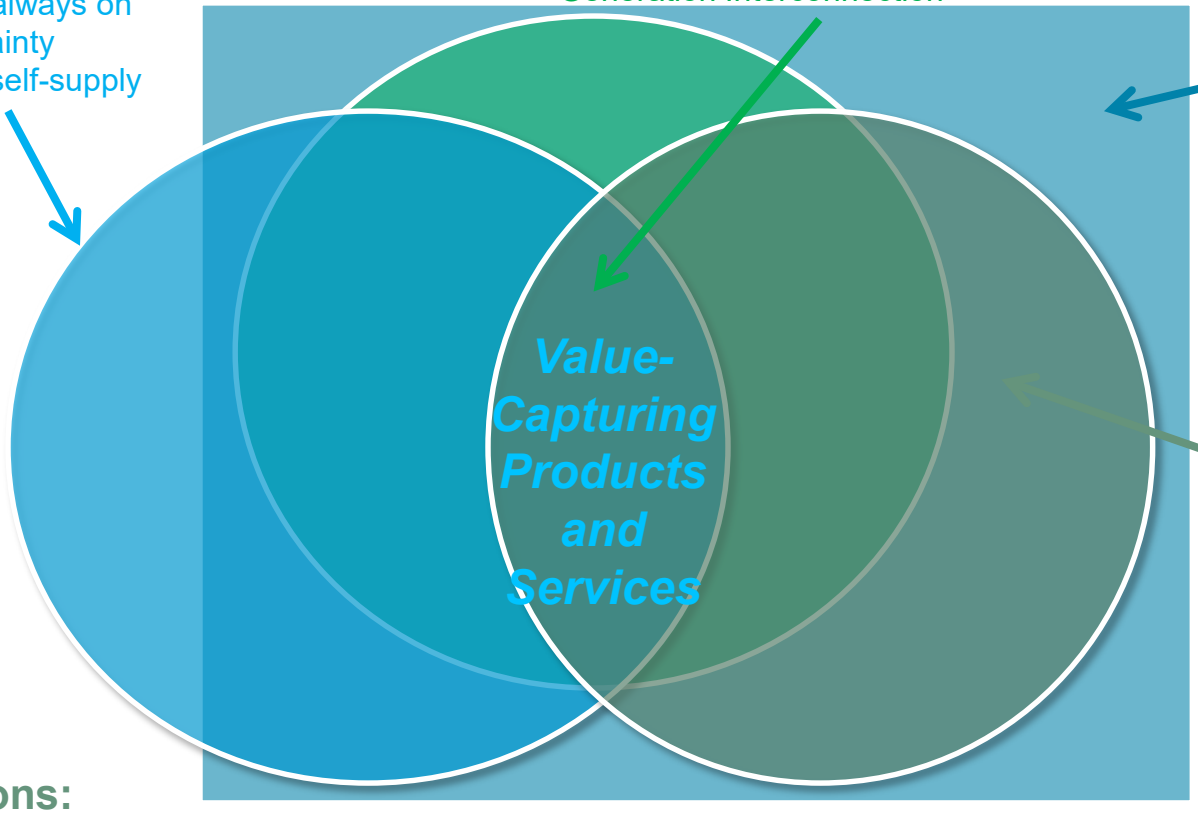


One View of *What are the Products and Services?*

Grid Products & Services
- Guaranteed energy delivery
- Flat rate
- Generation Interconnection

Grid Customer Needs & Wants
- Power is always on
- Cost certainty
- Ability to self-supply

Grid Attributes
- Size/Geographic spread
- 5.5 million end points
- Diversity of load/demand
- Diversity of supply



Grid Capabilities
- Keeping the lights on
- Absorbing variability
- Customizing pricing structures
- Delivering green power

Definitions:
- **Grid Attribute: Inherent characteristic (example: "Something we are")**
- **Grid Capability: Feature or faculty (example: "Something we can do or use")**
- **Grid Product: Something made to be sold or used, result of a process, marketed or sold as a commodity (examples: "a thing, a commodity")**
- **Grid Service: Action of helping or doing work for someone (example: "Action for someone's benefit")**

Business Strategy #3

- The Utility is constructing a strategic Itinerary

  Destination(s)
  - Which components of the Value Web should the Utility focus on?
  - Who are the targeted customers?
  - What Products and Services meet the needs and wants of those targeted customers?
  - What will be the Revenue Model?
    - All revenue models point away from strictly volumetric (cents per kWh) pricing
    - Some revenue models suggested “value-based” pricing rather than cost-based pricing

- To provide those products and services,
  and execute on the revenue model,
  what Capabilities does the Utility need to build?

- What are the Indicators to be used to suggest a change in itinerary?

PG&E's Mission, Vision, Culture

Our Mission

To safely and reliably deliver affordable and clean energy to our customers and communities every single day, while building the energy network of tomorrow.

Our Vision

With a sustainable energy future as our North Star, we will meet the challenge of climate change while providing affordable energy for all customers.

Our Culture

We put safety first.

We are accountable. We act with integrity, transparency and humility.

We are here to serve our customers.

We embrace change, innovation and continuous improvement.

We value diversity and inclusion. We speak up, listen up and follow up.

We succeed through collaboration and partnership. We are one team.

Business Strategy: The Journey Continues…

For more information or updates, please contact:

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