Climate Change Resilience and Preparedness

CPUC/CEC Workshop on Climate Adaptation in the Energy Sector

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Climate Change Resilience

- **Robust emergency response plans and procedures** to address near-term risks, including storms and wildfires
- **Active engagement** at the federal, state, and local level
- **Risk assessment and operational planning** to assess longer-term risks and prioritize infrastructure investments
- **Staying abreast of the science** through in-house climate change science team

CURRENTS

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JUNE 23, 2015

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Posted on April 22, 2015

PG&E Participates in New U.S. Climate Resilience Partnership Between DOE and Utilities

Risk Assessment: Natural Hazard Asset Performance

- **Long-term, multi-year, and holistic assessment of the risks from multiple natural hazard scenarios on PG&E assets:**
  - Identifying potential impacts to PG&E assets
  - Enabling the evaluation of climate-change-related risks to facilities and the development of necessary adaptation strategies

Risk Assessment: Natural Hazard Asset Performance

Key Steps of the Process

Planning Phase

Establish list of natural hazards; includes flooding, heat storms, and sea level rise

Develop natural hazard scenarios

Review Assets

Review assets against scenarios

Determine population of assets that may be affected

Risk Response

Develop response plans to accept or reduce risk

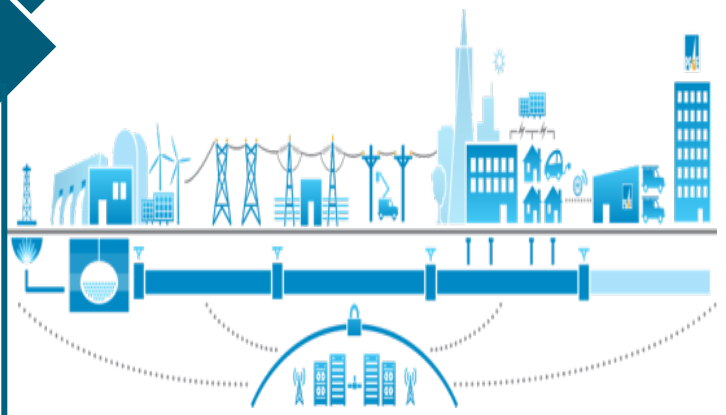
Monitor Progress

Monitor progress toward plans

Monitor climate change and effects on standardized scenarios

Inform Emergency Planning and Response activities

Path to a Resilient Utility



PG&E's Climate Change Science Team helped define several hazard scenarios, such as flooding, heat storms, and sea level rise.

Integration into PG&E's Strategic Planning Process

PG&E's Annual Integrated Planning Timeline

The results of the Natural Hazard Asset Performance process will inform PG&E's enterprise-wide Risk and Compliance Session in 2016, a key stage of our annual integrated planning process that shapes strategy and execution plans.

Sample Scenario: Flood

Scenario

- Assess PG&E assets against FEMA 100- and 500-year flood zone maps

Status of Risk Assessment

- Reviewed assets against scenario
- Currently developing risk response plans

Near-Term Actions Taken

Elevated structures at several PG&E substations:

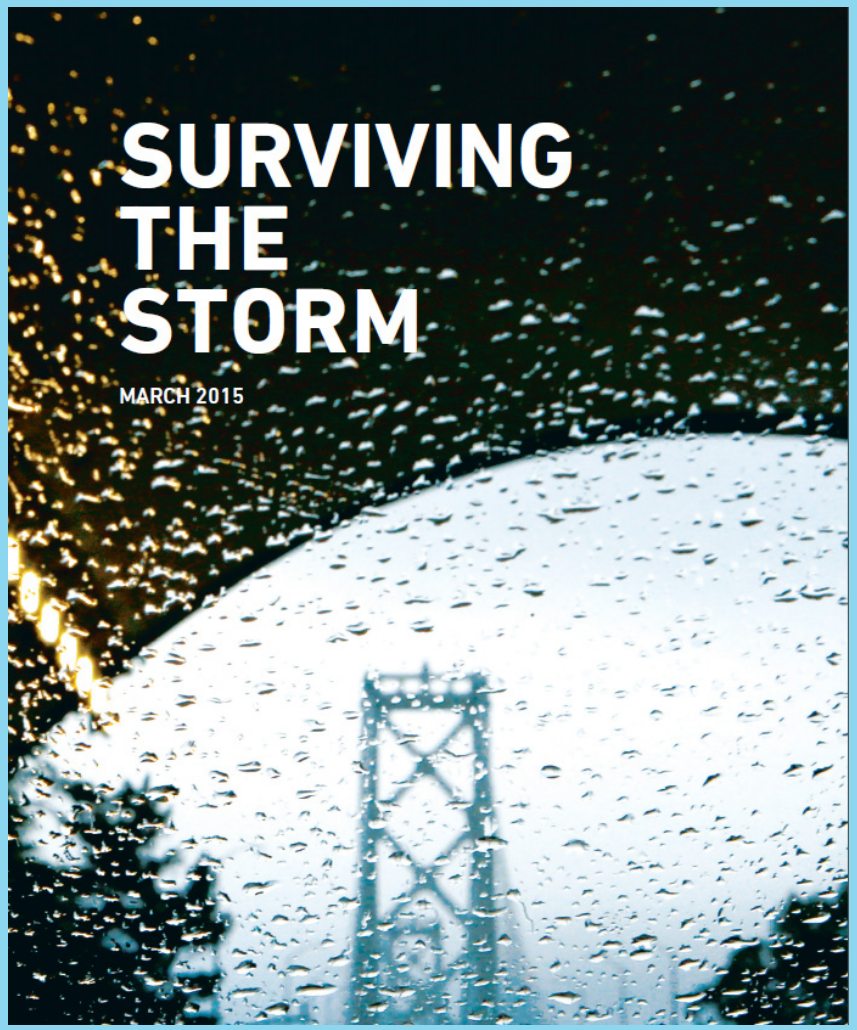
- San Mateo 115kV GIS building
- Napa Substation Building and Switchgear
- Richmond R Building and Switchgear

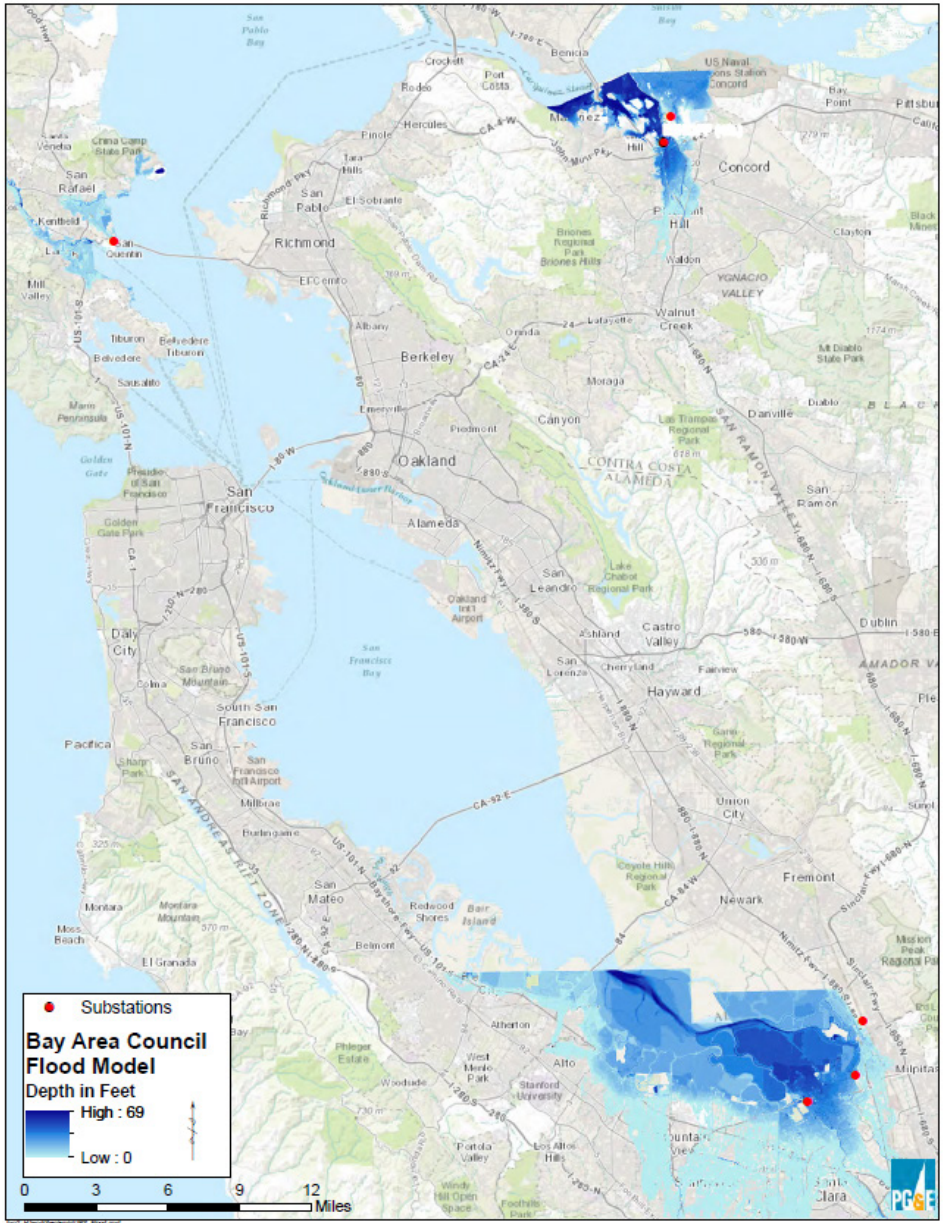
Partnering on Studies

PG&E participated in a recent Bay Area Council Economic Institute Report, which found that a Superstorm and associated flooding could have a $10.4 billion impact on the Bay Area economy.

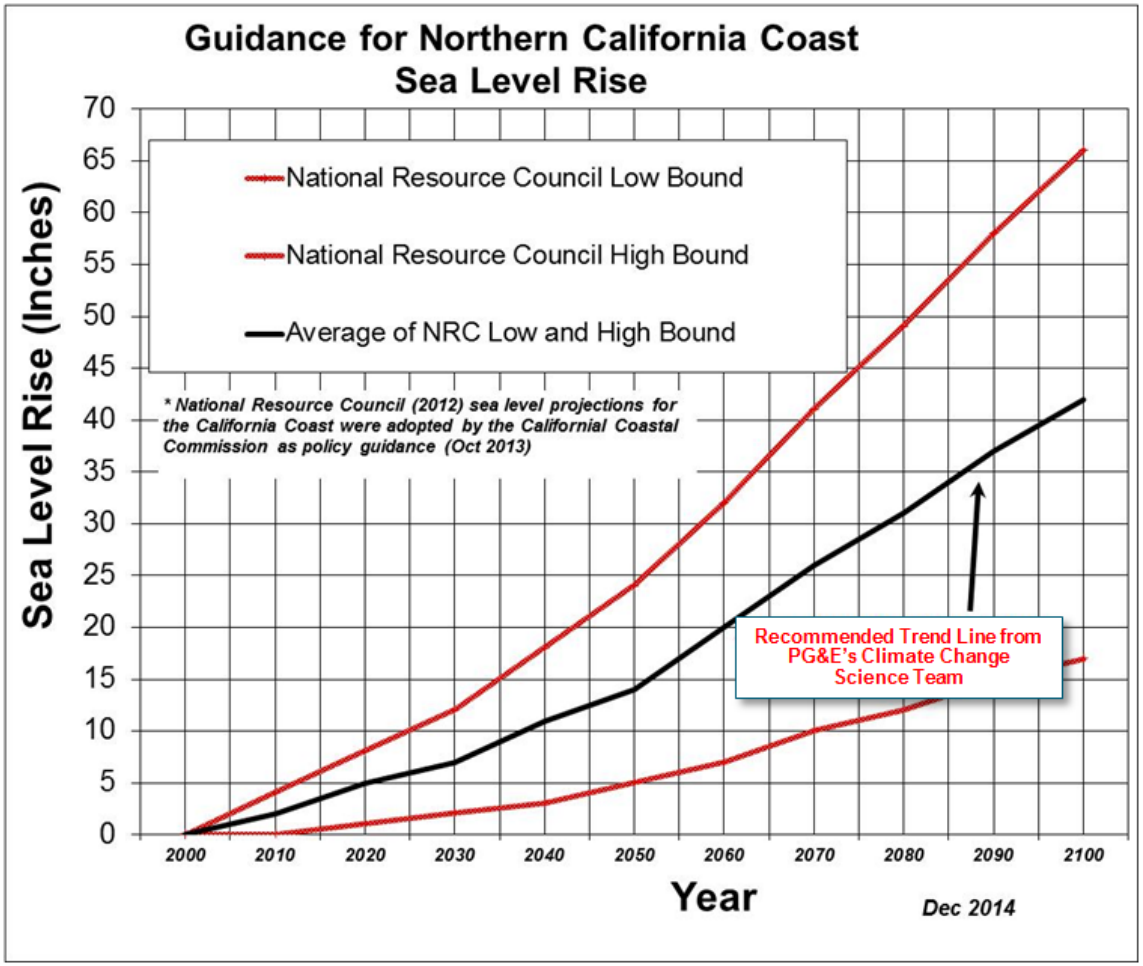
The report included solutions for creating greater regional resilience with a focus on the need for increased investment in flood control.

Surviving the Storm Report





Sample Scenario: Sea Level Rise



	Trend Line	Low/ High Range
Year	Inches	Inches
2010	2	0 – 4
2020	5	1 – 8
2030	7	2 – 12
2040	11	3 – 18
2050	14	5 – 24
2060	20	7 – 32
2070	26	10 – 41
2080	31	12 – 49
2090	37	15 – 58
2100	42	17 - 66

Sample Scenario: Sea Level Rise

Scenario

- 24 inch sea level rise by 2050

Status of Risk Assessment

- Reviewed assets against scenario
- Currently developing risk response plans

Near-Term Actions Taken

- Participating in nearly a dozen local government-led studies and initiatives
- Responded to recent request for state's Sea Level Rise Planning Database, as required under AB 2516

Engaging in Local Initiatives

PG&E is participating in San Mateo County's effort to identify and assess community assets and natural resources that will be most affected by sea level rise and storm events along the County's bayshore and coastline.

This is one of nearly a dozen local studies and initiatives in which PG&E is participating.

Sample Scenario: Heat Storm

Scenario

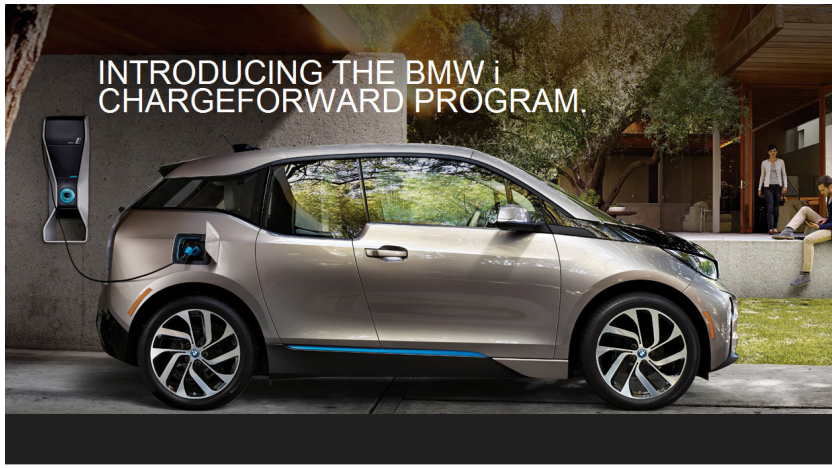
- July 2006 California heat-wave

Status of Risk Assessment

- Reviewing system against scenario

Near-Term Actions Taken

- Annual planning process to forecast peak load on our system relative to system capacity so we can take necessary steps
- Significant investments to modernize system—including automated equipment that dramatically reduces time to restore power to customers
- Robust demand response programs to mitigate peak demand



GET UP TO $1,540* FOR CHARGING YOUR BMW i3.

PG&E and BMW partner on smart charging

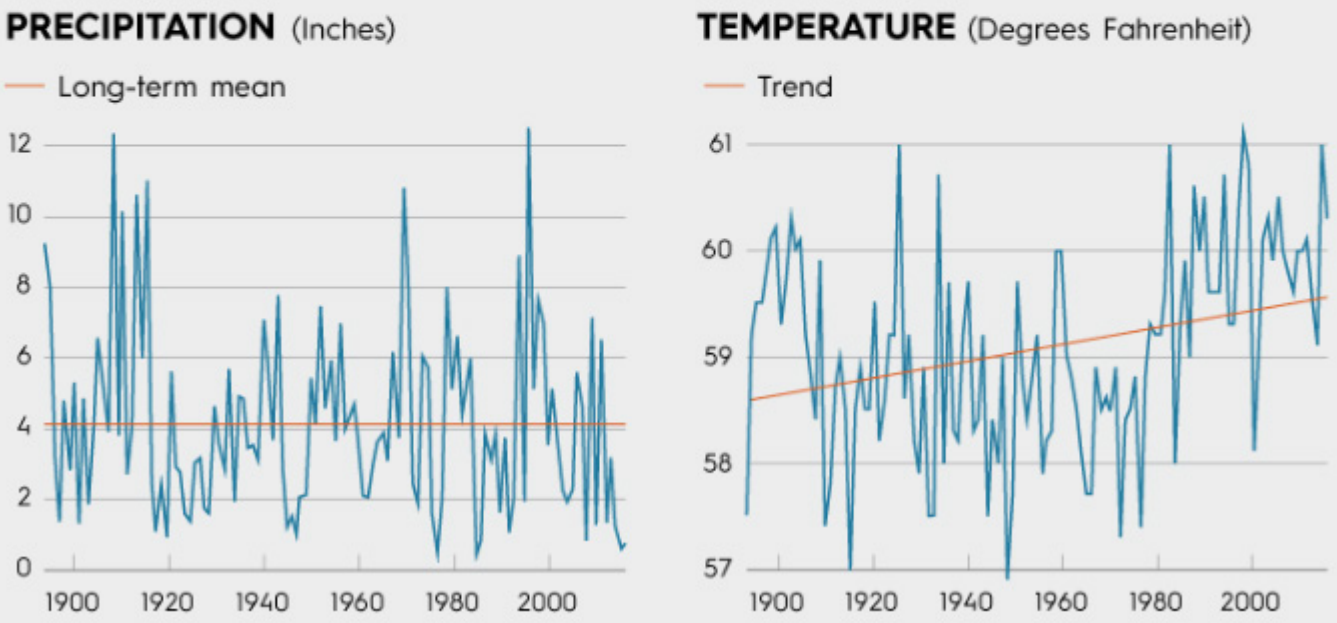
Through an innovative demand response pilot project, PG&E will pay BMW for the additional energy provided by up to 100 customer batteries for use on our grid, known as smart charging.

If PG&E needs to curb customer demand, BMW will signal the telemetry equipment in each participating vehicle, telling it to halt its charging for the duration of the event.

Low Precipitation and Snow Pack, High Temperatures

No Rain, High Temperatures

California has always battled drought in many forms, both meteorological drought (caused by below average precipitation rates) and hydrologic drought (caused by below average runoff from water sources). But the last few years have been unique. Precipitation rates are the lowest on record, and temperatures are rising.



SOURCE: http://www.visualnews.com/2015/04/13/californias-worst-drought-in-history-the-breakdown/

Drought Response: PG&E's Operations

- Established Internal Drought Task Force
- Addressing vegetation impacts on gas and electric infrastructure and coordinating with key agencies to prevent and respond to wildfires
- Managing water in reservoirs so clean, affordable hydropower is available during peak summer demand periods
- Maintaining dry-cooled power generation
- Reducing water use in our facilities and exceeded 5-year company water conservation goal
- Signed water-sharing agreement with San Luis Obispo County for PG&E's desalination plant

Managing Hydro Operations: Near-Term Strategies

- Strategically managing water supplies to optimize hydropower and the availability of water for fisheries and downstream users' needs
- Conserved water in our reservoirs in the spring
- Working closely with water agencies, first responders, and regulatory agencies in individual regions
- Continually analyzing reservoir and stream conditions

PG&E has worked with the Tuolumne Utilities District to manage our limited water supplies in the region. We have conserved water in our reservoirs so hydropower is available during peak demand periods of summer, and as much water as possible is available to support drinking water, environmental considerations, and other needs.

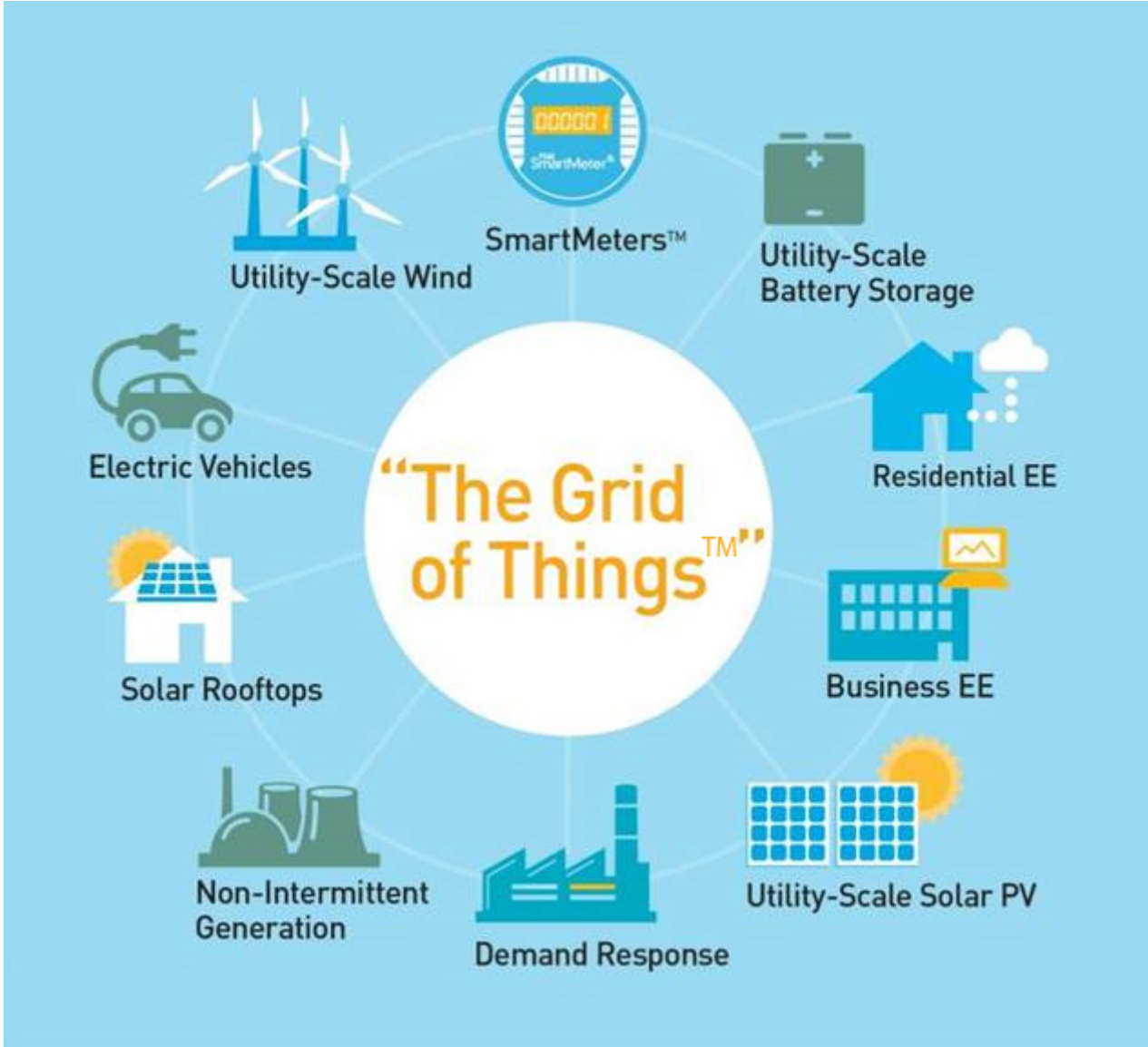
Managing Hydro Operations: Longer-Term Planning

- Collaborating on research and developing new modeling tools for forecasting runoff to plan for potential snowpack reductions in the Sierra Nevada Mountains
- Investigated Northern California's aquifers to better understand how they may respond to climate change
- New research with the University of California and DWR on a project to monitor snowpack, climate, soil moisture and other factors on the upper Feather River

PG&E has presented and published several scientific papers on our research into how climate change is impacting the Northern Sierra Nevada and Southern Cascade watersheds that supply our hydroelectric system.

Looking Forward: Grid of Things™

A smarter, more flexible, and more distributed grid will be a more resilient system in the face of a changing climate.



APPENDIX

Drought Response: Customers and Community

- Expanded agricultural energy efficiency programs and incentives
- Hosted Water Conservation Showcase to encourage building professionals to become more energy efficient by conserving water
- Collaborating with state agencies to reinforce the state's Save Our Water conservation campaign
- Working with Salvation Army, American Red Cross, food banks, and others to assist drought impacted communities

We offer customers a wide range of energy efficiency options to help them reduce their water use. We achieved water use savings of about 1.9 billion gallons in 2014, based on an analysis of our most common energy efficiency measures that promote water conservation.