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Renewables & Curtailment

CEC Workshop on Renewable Integration &
Electric System Flexibility

June 20, 2018

Sandra Burns

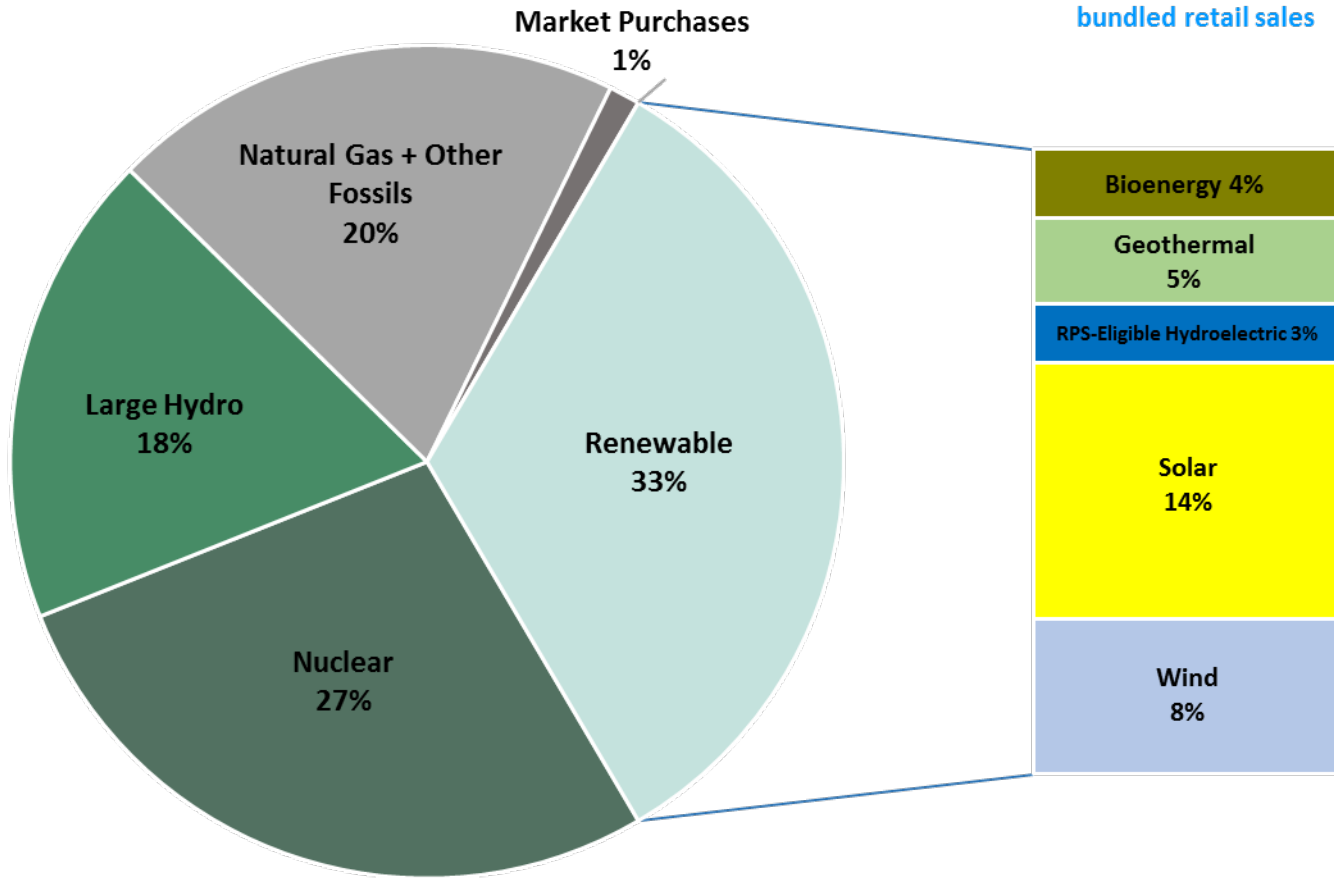


Together, Building
a Better California



PG&E's 2017 Electric Generation Portfolio Mix

Figures represent % of PG&E's total bundled retail sales



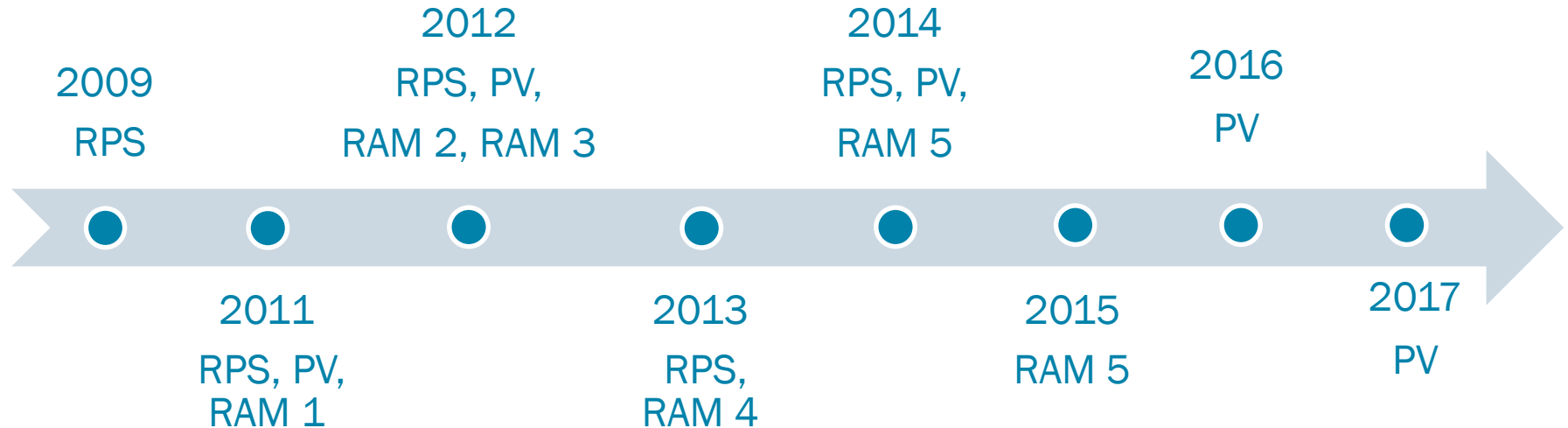
Note: "Market Purchases" is non-auditable electricity purchased from the market and generally reflects energy mix of the Western United States.

Data Sources: PG&E Fiscal Year 2017 10-K, submitted in February 2018

Due to rounding, numbers presented may not add up precisely to the totals provided.



Curtailment Provisions Have Evolved Over Time



2009-2011: No language related to economic curtailment. Buyer does not pay for any reliability curtailment.

2011-2014: PG&E pays for economic curtailment, but not for reliability curtailment. Limit to number of hours of economic curtailment per year.

2015-Current: PG&E pays Seller for economic curtailments, but not for reliability curtailment. Buyer curtailments are unlimited.



Current PPA Contract Terms

- Seller is responsible for providing project availability and local weather data at the site.
- PG&E is the SC and is responsible for economically bidding the project into the market.
- Seller is responsible for having ADS equipment and be responsive to CAISO dispatches.
- PG&E pays Seller for metered energy plus deemed delivered energy (what would have been produced but for the economic bid not being accepted by the CAISO).
- Deemed delivered energy is based on CAISO's VER Forecast.



Amending PPAs to Increase Flexibility

PG&E has sought to amend existing PPAs to increase economic curtailment flexibility

- Approximately 1,000 MW of additional curtailment rights since 2016.
- 53% of PG&E's non-hydro renewable fleet is flexible.
- Seller benefits by protecting against unpaid reliability curtailments that may otherwise occur if system issues are not solved economically.
- Buyer benefits from reduced exposure to negative market prices.
- In addition to system conditions, external drivers such as FERC Order 764, contract disputes, and changes to CAISO's PIRP exemption were drivers to modify curtailment terms.



Amending PPAs to Increase Flexibility

Challenges and complexity arise when implementing expanded buyer curtailment options:

- Automatic dispatch system equipment requires investment.
- Calculation of the energy that would have been delivered without curtailments (Deemed Delivered Energy) is prone to dispute.
- Compensated curtailment conditions (economic curtailment) and uncompensated curtailment (reliability) must be clearly defined.
- Value of Production Tax Credits may be lost.
- Responding to curtailment signals exposes Seller to penalties if instructions are missed

Q & A